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# MEDICAL SCIENCE

## Abstracts & Reviews

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# MEDICAL SCIENCE

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# REVIEWS

## SPINA BIFIDA

THE subject of spina bifida has this importance that there appears to occur one case of some phase of the deformity at least in every 1,000 births. In 1882 in England 649 children died from spina bifida, 612 within their first year.

The description of spina bifida in English text-books follows in the main that given in the able report of the committee of the Clinical Society of London, the members of which were Howard Marsh, A. Pearce Gould, H. H. Clutton, and Robert W. Parker.

The report of the committee was based upon the examination of a number of specimens preserved in various museums, but it had primarily been formed to investigate the results of the injection of an iodo-glycerine solution recommended by Morton in 1876. Of 71 cases treated by Morton's solution, 35 were numbered as recoveries because the sac had shrunk and in some cases was termed obliterated. But the deformities accompanying the spina bifida remained unaltered. Twenty-seven cases died after the injection, not all as the result of the injection. In 4 the swelling became less, in 5 it remained unaltered. This appeared to the committee a result superior to that which had been attained up to that time by excision of the sac.

A review of the previously recorded cases of excision suggests that the results were unfavourable owing to the indifferent selection of cases, and also on account of sepsis introduced at the operation.

In the same volume of the Clinical Society's transactions Sir A. W. Mayo Robson described 4 cases submitted to excision, and he followed this up in 1893 by a record of 20 cases in which his success had been principally when operating for 'meningoceles'.

Previous writers had regarded spina bifida as similar to hydrocephalus, a dropsical condition producing a hernia of the meninges.

In 1875 Virchow distinguished from spina bifida cystica the spina bifida occulta, in his case accompanied by hypertrichosis, covering a prolongation of the meninges backwards into a dorsal swelling. Since that time this part of the subject has become very large owing to the condition being accompanied by various nervous defects connected with imperfect spinal cord innervation.

The Clinical Society's Committee were disposed to look upon the defect as an arrest of development in the mesoblast closing in the spinal cord behind, and the collection of fluid to produce the cystic condition as a result of secondary irritation.

This view was also adopted by von Recklinghausen in 1886, and as he held that there was a defect in the closure of the meninges he concluded that there was no complete protrusion of the meninges.

Pathologists have directed attention to the conditions met with in anencephalous non-viable monsters with wider fissures of the spine—*rachischisis totalis v. partialis*, but the findings in such extensive deformities have but an uncertain bearing on the pathology of cases amenable to surgical treatment.

Of practical importance as suggesting a possible means of preventing the occurrence of the malformation is the experimental production of spina bifida in fish and amphibian embryos.

In 1892 Hertwig discovered that spina bifida may be produced in tadpoles by treating the ova of frogs with common salt. Other experiments have produced in the embryos of fish and amphibia anencephaly and cyclopia, so that there is abundant evidence to correlate the origin of spina bifida with external influences. Studies in the pathology of human embryos afford evidence of a connexion between spina bifida and uterine disease, of which the toxins affect the embryo, and thus the necessity of supposing amniotic bands or adhesions, or a faulty implantation, is eliminated.

There is in consequence a tendency to revert to the older view of a primary dropsy of the foetus. The collection of fluid within the meninges or central canal of the spinal cord may be the result of a local irritation set up by the toxins, or by the toxins weakening the foetal heart muscle. The fluid distending the meninges may then be regarded as secondarily checking the development of the mesoblastic covering and causing atrophy by pressure.

These observations suggest a careful inquiry into the history of previous births by the mother, and the necessity for a thorough gynaecological examination as to the question of concomitant uterine disease. Such examination has been notably absent in past records; as to the previous births there are many accounts which support the view that the deformity may be the result of uterine disease in the mother.

In a thesis dated February 1914, which includes a bibliography of 1,171 references, Hesse presented a review of the subject of spina bifida to which he added the records of 36 cases examined and treated in the Greifswald Hospital. Confining a notice of this paper to the surgical aspects of the question, one notes a divergence between pathologists and surgeons as to the frequency of occurrence of spinal meningocele, i.e. a hernia of the meninges only.

Pathologists in examining post-mortem specimens have found an involvement of the spinal cord which could only be demonstrated by a dissection of the spinal cord and sac, confirmed by a microscopic examination.

An apparent meningocele high up in the cervical region may turn out to be formed by a finger-like protrusion downwards of the cerebellum containing a cavity communicating with the fourth ventricle.

Even when an X-ray examination fails to show a gap in the vertebral spine and laminae, yet the wall of the cyst may be formed by a diverticulum from the spinal cord.

An oedema of the superficial tissues may also show the condition such as was described by Matthews Duncan in 1875 under the term spina bifida myxomatosa, in which there was a multilocular cystic degeneration of the coverings of a lumbar meningomyelocele.

Clinically the coexistence of other deformities and defects in the nervous system, especially of hydrocephalus, contra-indicates a simple meningocele.

There are also a number of cases on record of spina bifida anterior in which a cystic tumour bulges into the back of the abdomen or pelvis through a gap in the bodies of the vertebrae. The diagnosis of such a condition is facilitated by X-ray examination.

Hesse collected from the records of the Greifswald Hospital 36 cases.

1. Cervical meningocele, without deformities, excised, well but ill-developed 19 years later.
2. Lumbar spina bifida in an idiot with deformities and bed-sores; dismissed after healing of bed-sores.
3. Lumbosacral meningocele without deformity; excised; healed; nothing more known.
4. Lumbar meningomyelocele; ruptured at birth; died.
5. Sacral meningocele; excised; healed; developed hydrocephalus; died 9 months after the excision.
6. Sacral meningomyelocele; plastic operation; healed; developed hydrocephalus; died 3 months after the operation.
7. Sacral meningomyelocele with deformities; healed after plastic operation; nothing more known.
8. Lower cervical spina bifida occulta, a swelling the size of a pigeon's egg with hypertrichosis and scoliosis: treated with exercises and massage; nothing more known.
9. Lumbar meningomyelocele with prolapse of rectum; plastic operation; healed; nothing more known.
10. Lumbar meningomyelocele with paralysis; plastic operation; healed; nothing more known.
11. Lumbar meningomyelocele, a wide fissure with paralysis, in bad general condition; inoperable; died one month later.
12. Cervical meningocele, a fluctuating bilobed swelling with spastic paralysis of arms; excision declined; nothing more known.
13. Cervical meningocele with hydrocephalus; excised; healed; nothing more known.
14. Sacral spina bifida; ruptured at birth; died.
15. Sacral spina bifida with club feet; inoperable; died 1 month after birth.
16. Lumbosacral meningomyelocele, several deformities, bad general condition; inoperable; died at age of 3 months, it was said from diphtheria.
17. Lumbosacral meningocele with deformities and broncho-pneumonia; inoperable; died 9 months later.
18. Sacral meningocele with deformities, bad general conditions; plastic operation; died 5 weeks after from ascending suppurative meningitis.
19. Lumbar meningocele with paresis in child aged 3 months which had shrunk after repeated injections of alcohol, swelling 6 × 3 cm. persisting covered with eczema contra-indicating excision; nothing more known.
20. Lumbosacral meningomyelocele, posterior pole translucent with deformities; plastic operation; death from ascending suppurative meningitis.
21. Sacral meningomyelocele with slight paresis; plastic operation; recovered; well 3½ years later without improvement in paresis.

22. Spina bifida occulta; a fatty tumour in dorsal region; nothing more known.
23. Lumbar meningomyelocele with complete paraplegia and hydrocephalus; plastic operation; healed; scar bulged and ruptured 5 months later; died in a week.
24. Lumbar meningomyelocele with deformities and hydrocephalus; inoperable; nothing more known.
25. Lumbar spina bifida occulta with hypertrichosis; a vertebral gap shown by X-rays; no symptoms; not treated.
26. Cervical spina bifida occulta, a dermoid cyst with a pedicle connected (?) with the occipital region, in a boy aged 2 with fontanelles closed; cerebro-spinal fluid escaped after excision of the cyst; 3½ years later the boy was growing without any abnormality and with the scar firm.
27. Lumbar spina bifida with paraplegia and hydrocephalus; complicated by eczema; inoperable; nothing more known.
28. Lumbar spina bifida occulta with hypertrichosis without deformity; excised; 1¼ years later in good condition except for flat-foot.
29. Cervical spina bifida occulta in a man aged 42, the man then suffering from facial neuralgia and tic.
30. Lumbar meningomyelocele with paresis; healed after plastic operation; in good general condition 8 months later, without improvement in the paresis.
31. Spina bifida occulta; a myofibrolipoma in the lumbar region with a hollow pedicle connected with the meninges without deformities; recovery after excision followed by increasing cystic protrusion of the scar and hydrocephalus.
32. Dorsolumbar meningomyelocele leaking from birth; death 10 days after plastic operation from ascending suppurative meningitis.
33. Sacral spina bifida occulta without symptoms but a gap shown in the sacrum by X-rays; no treatment.
34. Lumbosacral meningomyelocele leaking from birth with marked club feet; death from ascending purulent meningitis.
35. Sacral spina bifida occulta with marked club feet and hypertrichosis of lower limbs in a man aged 27 who had suffered until 13 from nocturnal incontinence; treatment limited to correction of the club feet.
36. Lumbosacral meningomyelocele with hydrocephalus and paresis; inoperable.

The foregoing list of cases observed at Greifswald appears to afford an approximate summary of what has been recorded by others:

(1) Infants are often seen with a ruptured or leaking spina bifida. Suture has been attempted in the more likely cases, but hardly ever with success. Death nearly always follows within 10 days from ascending septic meningitis.

(2) Cases are inoperable from *local causes*, because the coverings of the spina bifida, skin, fascia and periosteum, are too thin to permit of a plastic operation which will ensure healing by first intention, or the coverings of the posterior pole are already inflamed—eczematous or ulcerating. It is then most likely that however good the plastic operation it will be followed by ascending septic meningitis.

(3) Cases are inoperable from *general causes*—wasting, diarrhoea, broncho-pneumonia, but may improve under good nursing.

(4) Cases otherwise operable, presenting symptoms of partial or complete paraplegia—incontinence of urine, prolapse of the rectum, spastic or flaccid paralysis of the lower limbs and signs of hydrocephalus, mental defect or idiocy—may be operated upon successfully for the local condition. But no improvement from the excision of the spina bifida can be anticipated as regards the complications. If hydrocephalus develops, the scar after the plastic operation will show an increasing distension and a recurrent cystic tumour forms. Rupture and septic meningitis will then supervene sooner or later.

(5) The excision of a spina bifida occulta will not be followed by improvement in the complications, incontinence, spastic and neuralgic symptoms, perforating ulcers.

As to the local condition, if it includes a dermoid cyst, or there is an oedematous distension of subcutaneous tissue, excision is indicated. Hypertrichosis and small fibrolipomatous swellings may well be let alone. No excision should be done until bed-sores, perforating ulcers, and eczema have been cleared off. Great care should be taken to identify and ligature the pedicle communicating with the meninges.

(6) Plastic operations are required in the lumbosacral region. The cauda equina has to be detached and laid down in the spinal canal, then the meninges, periosteum and fascia, and skin have to be brought together without tension, so as to secure primary union.

The child should generally be laid prone across a pillow and so nursed until the wound has healed.

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W. G. S.

# HABITUAL OR RECURRENT DISLOCATION OF THE SHOULDER

The term habitual or recurrent dislocation of the shoulder is one to be applied when there happens a frequent recurrence of the dislocation without practically any amount of force being required. It is not, therefore, an instance of a traumatic dislocation having happened more than once owing to a repetition of a similar accident. Nor is the term applied to a voluntary subluxation or dislocation which can be voluntarily reduced. Nor is it an instance of an imperfectly reduced dislocation, nor of a dislocation which does not remain reduced, nor of one which cannot be reduced. It differs, further, from a pathological dislocation, whether owing to congenital defect, or to acquired disease of the joint, or brought about by a nervous lesion, paralysis, tabes, or syringomyelia. Seidel collected 117 recorded cases of habitual or recurrent dislocation; in 30 of these the joint was examined *post mortem*. Nearly all were instances of subglenoid or subcoracoid dislocation, downwards or downwards and forwards; only a few were instances of subspinous posterior dislocation, and in but one was there an upward subclavicular dislocation.

The majority of cases were men in middle life; the dislocation in many recurred through a long series of years, in some patients it had recurred over 100 times, and in some the recurrences had become innumerable.

Generally the dislocation was stated to have been in the first place caused by a fall or blow on the shoulder, or by a fall on the outstretched hand or abducted elbow; subsequently the dislocation was liable to recur when the arm was abducted and the patient bore weight on his hand or rested on his elbow. If it recurred by a direct cause, the force applied to the shoulder was of the slightest.

In consequence the patients suffered from pain and swelling in the joint to variable degrees, and were not relieved until the dislocation had been reduced. The tendency to recurrence and the pain caused excited such fear as to restrict the patient's use of his arm and his working capacity. He kept the arm to the side for fear of risking a dislocation in abduction. Cases of habitual dislocation have also originated and recurred in epileptics by muscular force, quite apart from any fall, and without the arm being abducted. The dislocation may recur with the patient lying down with his arm to his side, or even whilst asleep.

The chief lesion which has been connected with habitual dislocation is a special dilatation of the capsule in the direction of the common subglenoid or subcoracoid dislocation. A general dilatation of the capsule is of doubtful occurrence; the normal capsule would enclose a head of the humerus double the natural size.

This special dilatation has not been found large enough to receive the normal head. But it represents the position of the primary rent in the capsule which subsequently healed. There does not occur a fresh rent when the dislocation has become habitual; only in one case was a fresh rent noted when exploring the joint. Even at a post-mortem examination signs of an old rent have not usually been seen.

In a few cases, on X-ray examination, signs of a defect or the tearing off of the tip of the greater tuberosity off the humerus have been found. At post-mortem examinations it has been found that the insertions of the external rotators had been partially ruptured, with a shortening of their insertions and a weakening owing to the tendons ending in scar tissue attached to the loose capsule, underneath the acromion and deltoid muscle. In a few cases, on opening the joint, a movable body, pedunculated or loose, has been found, which may have become sometimes interposed between the joint surfaces. Such bodies may have originated from a piece of detached articular cartilage of the head of the humerus, or from the glenoid ligament. A defect may be found at the lower margin of the joint, where the capsule and periosteum have been stripped off from the adjacent neck of the scapula underneath the subscapularis. There is thus formed a diverticulum which may communicate with the subscapularis bursa. As distinguished, however, from an old unreduced dislocation there is no tendency to the formation of a socket on the neck of the scapula, but the head of the humerus may become flattened posteriorly above its anatomical neck. In the exceptional instances of a posterior dislocation, a stripping up of the periosteum under the infraspinatus has been recorded.

There have been many conjectural explanations put forward to account for the recurrence of the dislocations.

(1) Malgaigne supposed that the rent in the capsule remained unhealed owing to early and excessive use of the joint. This has not been confirmed neither by post-mortem examinations, nor during exploration when operating.

(2) Roser modified Malgaigne's view by supposing a communication with the subscapularis bursa. More exact observation has shown that the diverticulum results from a rupture of the glenoid ligament and a stripping up of the periosteum off the neck of the scapula. A communication with the subscapularis bursa is secondary.

(3) Desault and others supposed an intrusion of the rent capsule, which became interposed between the joint surfaces, so as to keep them apart. But when a movable or loose body has been found, it has not been interposed between the joint surfaces but has been situated in the subglenoid region.

(4) Thomas ascribed the recurrence of the dislocation to a dilatation of the capsule in the direction of a subcoracoid dislocation, forming a hernia-like protrusion of the capsule.

(5) Clinical observations, including X-ray examinations, point to a weakness of the external rotators, either as the result of a primary rupture, or as the slower result of frequently being stretched during the dislocation. This disturbs the equilibrium, leaving the subscapularis aided by the deltoid muscles unopposed.

**Treatment.**

A. By restricting use:

*a.* The prolonged bandaging to the side, so as to prevent abduction, has in a few cases afforded relief. In the majority, dislocations have recurred as soon as the arm was freed. Moreover, dislocations occurring during epileptic attacks are not prevented by the arm being bandaged to the side.

  *b.* A perforation of the axillary folds by the cautery was used by Hippocrates.
  *c.* Malgaigne recommended the notching of the capsule by using a tenotome subcutaneously.
  *d.* Injections around the capsule of chloride of zinc, &c.
  *e.* Injections into the joint of iodine solution, &c.
  *f.* Excavating the glenoid cavity.

B. By increasing mobility in order to save the patient from pain and the necessity for seeking aid:
  *a.* By excision of the head of the humerus.
  *b.* By arthrodesis; a portion of capsule being inserted between the joint surfaces.

C. Measures which have recently been adopted:
  *a.* Capsulorrhaphy.
  *b.* Advancement of the external rotators, or other plastic operations.
  *c.* Division of the insertion of the subscapularis.

**The reduction of the capsule, capsulorrhaphy,** has been tried through various incisions for exposing the joint, a vertical incision through the anterior fibres of the deltoid, or more internally along the inner border of the deltoid, or extending this by raising the deltoid muscle as a flap, or posteriorly by an incision along the spine of the scapula or the acromion.

Better results have followed the axillary incisiona dopted by Thomas and Telford. At first Thomas used an anterior axillary incision. The axilla was laid open just behind its anterior fold; the wound margins being strongly retracted, the capsule was reached in front of the axillary vessels and nerves. But the forcible retraction tended to do harm. Hence Thomas in a subsequent series of 18 cases exposed the capsule behind the blood-vessels. The incision was made along the posterior fold of the axilla and the margins retracted so as to expose and identify the glistening tendon of the latissimus dorsi. Immediately in front of this lies the muscular insertion of the subscapularis. The subscapularis is retracted upwards and the latissimus dorsi downwards. Crossing the capsule so exposed one must recognize the circumflex nerve and artery, and if the head of the humerus happens to be dislocated, the circumflex nerve may be pushed forwards so as to be superficial. At the lower part of the space the dorsalis scapulae artery is to be noted and may be divided between two ligatures. The capsule can now be incised vertically, exposing the joint. An examination of the joint should be facilitated by rotating the head, when loose bodies, or portions of the glenoid margin, &c., which have become detached may be removed. After this the capsule can be repaired, including the obliteration of any sacculus protruding in the subglenoid region under the subscapularis. A firm scar is obtained by overlapping the margins of the capsule and so fixing them by suture. A drain should be inserted for the first day and the arm kept to the side for a fortnight, or in the case of an epileptic for a month. Then the patient may begin to use his arm by putting it through his shirt-sleeve; a fortnight later he may try to climb a rope or hang on a bar. Subsequently he may return to athletic exercises without danger of relapse.

This operation has been found successful in arresting the recurrence of dislocations in all but old-standing cases with changes in the head of the humerus.

**Plastic operations** have been done without opening the joint.

W. Müller and Perthes advanced the retracted tendons of the supraspinatus and infraspinatus. For this it is necessary to turn up the deltoid muscles as a flap.

Another plastic operation originated with Clairmont and Ehrlich and was modified by Seidel. Through a posterior incision the posterior third of the deltoid was raised from its insertion along with a strip of the deep fascia of the arm continuous with the tendon. Then, aided by an anterior incision, this portion of the deltoid was pushed around behind the surgical neck of the humerus into a buttonhole made in the fibres of the anterior third of the deltoid, where it was fixed by suture. Care must be taken not to injure the circumflex nerve. The object of the operation was to reinforce the weakened external rotators, it being no drawback that the deltoid was in doing so weakened as far as regards its natural action. But although the portion of the deltoid could be thus carried round the humerus when trying the operation on the cadaver, this could not be done on the living subject unless the deltoid tendon were lengthened by a strip of fascia. In such plastic operations, so much scar tissue is formed as to restrict the subsequent use of the arm.

**Division of the insertion of the subscapularis.** This is a relatively simple operation which may be adopted in such a case as described by Spencer.

A man aged 24, employed in a boot store, had had epileptic fits since childhood. The fits had always occurred during sleep, without an aura, but he had malaise on waking. For more than a year he had had repeated dislocations of the right humerus into the axilla. They occurred during sleep, whilst his arm was by his side; he found the dislocation on awaking, and had always to seek a doctor to have the dislocation reduced. The left shoulder had also been dislocated twice. Nothing abnormal could be detected on external examination, nor was any abnormality discovered when the joint was explored. In particular the capsule did not appear to be dilated. On the theory that the violent action of the subscapularis during the epileptic fit was the main cause of the dislocation, the head of the humerus was rotated outwards and the subscapularis insertion divided. The wound healed without any limitation of the joint. During healing the night nurse noted him in a fit during sleep on three nights and she inserted a gag. He reported himself later as having had a fit about once a fortnight. There had been no dislocation of the right shoulder since the operation. The left shoulder had been dislocated twice. As he was at light work a similar operation of the left shoulder was not sufficiently indicated.

Similar operations for weakening and lengthening of tendons have been subsequently described by Young and by Röpke. Young divided the lower portions of the insertions of the pectoralis major and latissimus dorsi.

Röpke was successful in the case of an epileptic by the division of the subscapularis tendon.

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## REPAIR OF TISSUES DESTROYED BY INJURY AND DISEASE

Bier, under the title 'Observations on Regeneration in Man', in a long series of articles and in an unsystematic and diffuse style, discussed what he distinguished as pathological regeneration. In the course of these articles there are included many observations on the repair of various tissues after destruction whether by injury or by disease. Embryological and physiological regeneration received notice only so far as they afford explanations of the repair in human tissues. Only passing allusions were made to the histology and bacteriology of wounds and their healing, as well as to the methods of transplantation and to experiments on animals.

There are two great causes of the destruction of tissues:

*a.* External injury including injuries by chemical substances and by heat and cold.

*b.* Infection, by which gaps are made and normal cavities and spaces obliterated.

The most highly organized structures, the brain, spinal cord, and the special sense organs, do not admit of repair in the direction of restoring pre-existing structures or functions.

The organs of metabolism and of generation are not restored so far as structure is concerned, but there may be indirectly a restoration of function brought about by compensatory hypertrophy.

Restoration in various degrees, according to circumstances, occurs in such organized structures as:

(1) The bones and joints with their marrow, periosteum, blood-vessels, and nerves.

(2) The muscles, including muscle fibres, tendons, external sheaths and internal septas with their blood-vessels and nerves.

(3) The skin with its appendages, glands, hair, nails, including the epidermis, dermis, and subcutaneous tissue with their blood-vessels and nerves.

The various components of these organized structures show different degrees of activity. The connective tissues, bones, and cartilages present a passively mechanical resistance to both injury and infection. The active part in regeneration is undertaken by special cells as regards structure.

In respect to the restoration of function, great importance is attached to the sheaths and septa within which the various organized structures—muscles, blood-vessels, nerves, bones—are packed, and the septa serving for the origin and insertion in part of the muscles.

Movement of the various parts on one another is provided by lymph spaces for the cellular connective tissues, subcutaneous, intermuscular and parosteal. Serous surfaces, peritoneal, pleural, subarachnoid, also synovial and bursal, are smeared with a lubricating fluid to provide for the mobility of organs. The slimy characteristic is best perceived by the finger when examining a freshly amputated limb. Mobility is not confined to serous and synovial surfaces. The mobility of the cellular tissue in the prevesical space is well illustrated by comparing it with the bladder full and with the bladder empty. The method of blunt dissection also demonstrates that such tissue can be readily displaced without causing haemorrhage or injury to nerves and other structures. But this loose connective tissue favours the spread of infection by pyogenic organisms, staphylococci, and streptococci. Also influencing the restoration of function is the interference with blood-vessels and nerves conducting in either direction and the mechanical destruction cutting off connexion with the periphery or with the centre. Infection has chief influence upon the centripetal veins and lymphatics.

The relation of a part with neighbouring structures and its relation to the exterior have to be kept in view. The natural coverings include dense resistant structures on the one hand, and elastic mobile cushion-like bodies on the other, which combine in protecting against external injury, whilst the natural mobility of the part allows of such displacement as wards off the full impact of a blow.

Older writers tended to regard repair as mainly a filling of the gap by scar tissue, an undifferentiated, poorlyv ascularized and innervated tissue, covered by a thin adherent epidermis without sweat glands or hair. The scar tissue also fixes the structure beneath, preventing or limiting the use of muscles. If a muscle is divided, it tends to become two-bellied, with an intervening mass of fibrous tissue fixed to its surroundings. Such scar tissue formation should not be regarded as a real process of regeneration but rather as a malformation composed of diseased tissue. It is essentially the same kind of material as that produced by such infections as syphilis and gonorrhoea, as that formed in the growth of scirrhous cancer, as that which impairs the function in the case of cirrhosis of the liver, granular kidney, and ischaemic contracture of muscle.

Scar tissue is to be regarded as a diseased process following upon disturbance in the circulation of blood and lymph, which, when entirely arrested, results in necrosis and, when restricted, fails to supply cells with sufficient nutriment. A marked peculiarity of gunshot wounds is the disproportionate destruction of muscle.

Toxins causing inflammatory fibrous exudations are particularly important, by filling up and blocking lymph spaces in pneumonia and causing adhesions of serous surfaces in pleurisy.

The regeneration of the various tissues is dependent on certain factors:

1. The character and extent of the injury producing the gap. The tissue which takes the more active part in the regeneration of an organized structure may undergo different degrees of destruction. Thus when the

tail of *Triton cristatus* is chopped off, a perfect regeneration of the tail follows, but if it be amputated by a double circular cut and the skin united over the stump, no regeneration follows. As to the extent of the gap, experience connected with transplantation of the skin and with the union of fractures supplies evidence. Whilst a limited gap favours regeneration, if large, abnormal movements and other things oppose regeneration.

2. The existence of a special stimulus has been the subject of a number of conjectures in addition to the assumed persistence of embryological and inherited characteristics.

Influences, formerly attributed to nervous sources, are now referred to internal secretions or hormones: the effect of the thyroid secretion and of the lack of it, the influence of castration and of oophorectomy, the functions of the adrenals and pituitary body. Pregnancy excites the breast to activity on the one hand and on the other delays the union of fractures.

The following experiments suggest stimulus by a hormone:—

When the lens is extracted from the larva of a triton, it is re-formed from the epithelium at the base of the iris. But if a bit of the iris, after extracting the lens, is transplanted into the posterior chamber, a lens is re-formed more highly differentiated than that formed by the epithelium still connected with the iris. On the other hand, the transplantation of a bit of iris into the posterior chamber, without extracting the lens, was not followed by any new lens formation. These experiments suggest a secretion by the retina of a hormone facilitating regeneration of the lens after extraction.

3. The healing of wounds, whether aseptic or infected, may be considered as being stimulated by the intervention of hormones derived from neighbouring unimpaired structures or through the blood-stream. Such hormones may be held to counter the toxins opposed to regeneration, resulting from cell destruction and from micro-organisms.

4. Hyperaemia as a factor in regeneration is a subject of controversy. Bier regards both active hyperaemia as well as the passive hyperaemia produced by the application of his band, as factors favouring regeneration. There probably results an accumulation in the tissues of carbonic acid and perhaps of lactic acid which may be stimulating agents. The febrile reaction following injury may be the result of a stimulus acting upon the heat-regulating centre, whilst leucocytosis is the effect of stimulation of the bone marrow, spleen, and lymphadenoid tissues. On the other hand, such stimulation may be unnecessary for healing because an aseptic wound may heal without any naked-eye sign of hyperaemia or any elevation of temperature.

The relation of blood clot to regeneration continues obscure. In the subcutaneous union of fractures and in the course of the repair of the tendo achillis blood clot is always present. In such cases the blood clot may afford nutriment or a stimulating hormone to the cells taking part in regeneration. It may be, however, that influences favouring regeneration are able to overcome drawbacks due to the presence of clot. In other cases blood clot is detrimental to regeneration.

6. Nervous influence on repair remains obscure. An acute so-called reflex atrophy of muscles follows injury or inflammation and is especially marked in the quadriceps extensor cruris when the knee-joint is involved. A commencement of the atrophy has been noted after 24 hours, and within a few weeks it may become very marked. In the case of the shoulder-

joint, the deltoid undergoes atrophy, and this becomes the more marked when the joint remains fixed and undergoes ankylosis. Along with this muscular atrophy is to be noted on X-ray examination an atrophy of underlying bone. Atrophy from disease is quite insufficient to explain such cases.

On the other hand, the absence of nerve influence does not prevent repair after tendon and muscle operations on the paralysed limbs of children. Wounds in the lower extemities of men suffering from paraplegia following gunshot injury to the spinal cord have healed; bed-sores heal in such patients, as well as stumps after amputation. Even if the healing of a wound be regarded but as a simple variety of regeneration, yet fractures of the lower limbs in such cases of paraplegia have united after the formation of callus. Moreover in the cases mentioned above of acute atrophy of bone following tuberculous disease of the hip or knee, fractures produced by osteotomy unite firmly.

That nerves exert some influence on regeneration may be supposed from experiments on amphibia larvae. Regeneration of forelimbs may occur completely after they have been cut off, but if the corresponding axillary plexus is divided there is no restoration.

7. Cytotropismus or cytotaxis, and neurotropismus are names suggested since the discovery of chemiotaxis. Older writers employed the general term sympathy. As instances may be mentioned the islands of epidermis started by Reverdins's method of grafting spreading out to fuse with one another. The attempts of axis cylinders to grow out from the proximal end of a divided nerve may be cited as an instance of neurotropismus.

**Tendon regeneration.** The repair of the tendo Achillis after tenotomy supplies an instance of extraordinary rapid restoration of function. Paget described in his lectures on surgical pathology how he demonstrated this by attaching a weight to the tendo Achillis of a rabbit six days after it had been divided by subcutaneous tenotomy. On hanging the repaired tendon up by one end and attaching a weight to the other it was found that the weight had to be increased to 20 lb. before the tendon parted. In another experiment with a rabbit's tendon tenotomized 10 days before, the tendon resisted weights up to 50 lb. before it tore through at the site of the regeneration. Although seven or eight days after tenotomy there is an appearance of fibres, the splice before ten days mainly consists of cellular elements. Such elements can serve as a functionating tendon so that the muscle can be used by the animal before the regeneration of the tendon is completed. The rapid regeneration of the tendon is due in large measure to surrounding connective-tissue cell elements. Yet the regenerating tendon rapidly assumes its normal shape and begins very soon to move freely on the surrounding connective tissue. Following immediately upon the tenotomy the gap between the separated ends of the tendon is filled with blood clot. This is to be noted in all animal experiments, and is sufficiently proved at surgical operations, for blood can be squeezed freely from the puncture made by the tenotome. There must follow at once some active stimulus, not only of the tendon corpuscles at the ends of the divided tendon, but of the connective tissue and endothelial cells surrounding the gap. This suggests the secretion of a stimulating hormone from the divided ends of the tendon, or its origin from the blood clot.

The repair of the tenotomized tendo Achillis is complete both as regards shape, mobility, and function. It shows no tendency to stretch under the pull of muscles. But this regeneration of the tendo Achillis exhibits marked difference from what occurs in tendons moving in a synovial sheath. When these are divided and the ends retracted, no such splice develops between the ends, which become glued by scar tissue to the sheath in their retracted position, whilst the sheath degenerates into a band of scar tissue. It is necessary for the ends of such tendons to be united by suture, and the muscle must be kept relaxed until the union is firm, or it will stretch. Moreover blood clot should be eliminated, for it tends to form scar tissue and prevent the tendon from regaining mobility. Also the synovial sheath does not assist in the regeneration of the tendon; on the other hand, if the sheath inflames, the tendon becomes fixed and may fail to regain its mobility, even although the cut ends have united. The splice which regenerates the tendo Achillis differs from the scar tissue forming between the separated surfaces of the patella or olecranon following a transverse fracture, for this scar tissue stretches under the pull of the muscles. Also ruptured ligaments, such as those of the knee-joint, are repaired by a scar tissue which tends to stretch.

Thus, whereas use in the case of the tendo Achillis is favourable to an early restoration of function, in the case of other tendons early use is antagonistic to a good regeneration.

**Union of Bone.** One explanation of union after a simple fracture is that it is the result of a mechanical stimulus; the movement of the two ends following upon the solution of continuity stimulates osteoblastic cells of the periosteum, endosteum, and of the cancellous tissue to form callus. When the callus has developed so as to fix the fractured ends the stimulus to cell proliferation subsides.

Against this view may be set the experience gained by the fixation of fractures both by splints and by operations. On the other hand, the movements of the ends tend to result in mal-union or non-union. The fractured ends then become covered with a cartilaginous formation which produces a false joint; or if the ends are united by scar tissue, the proximal end especially tends to become conical, and, differing from that in a stump, the end is sclerosed and the medullary cavity obliterated for some distance up. The end of a bone in a stump, although terminating in a cone, shows an increased medullary cavity from eccentric atrophy. Also in the case of mal-union there is a transformation of structure in the bone above the fracture. As demonstrated by Wolff, the septa of the interior of the head and neck of the femur are transformed to accommodate the bone to the altered line through which the weight of the body above has to be transmitted.

The regeneration resulting in the union of a simple fracture appears to be stimulated partly by blood clot and partly by a secretion of a hormone from the bone marrow. The periosteum seems to take part especially in the formation of the preliminary external callus; the definitive internal callus results from the bone marrow, which may so complete the regeneration that all signs of the previous fracture may be lost. Such conclusions may be drawn from the observations made in taking sections of bone from the tibia to serve as bone grafts. The removal of a section of the tibia 7 cm. in length and half the thickness of the bone including the sharp crest left, as the floor of the gap, the medullary cavity and neighbouring cancellous bone. This gap was filled with blood clot and the skin united over it. Observations were continued after healing by means of X-rays and the new formation of bone observed. The bone became accurately replaced including the crest, and there was neither excess nor deficiency, either at the junction with the remainder of the tibia or on the external surface of the newly-formed bone. A year later the graft was exposed. The skin over the new bone was freely movable on the subcutaneous tissues and periosteum. The fascia over the periosteum was a little thicker and denser than normal; it was also united to the periosteum more firmly but was readily separable. No difference is noticeable, whether or not the periosteum is taken with the graft. New periosteum is reproduced by ingrowth from the margins.

The periosteum over the new bone was somewhat thickened, but could be easily raised from the new bone including the fresh tibial crest, and under the microscope proved to be differentiated into the natural layers. An examination of the exposed new bone failed to indicate any distinction between it and the rest of the tibia.

In the case of a boy aged 13, from whom a graft 16·5 cm. in length was taken, extending in depth to the medullary cavity, an X-ray photograph a month later gave a representation of the gap occupied by structureless bone, exactly level with the old and including the appearance of the crest. To palpation the gap seemed to have been completely filled by new bone.

When, however, the tibial graft was cut from the surface of the tibia without going deep enough to reach the medullary cavity, and the periosteum after being raised laid down over the gap, then there was but an irregular filling in of the gap, although it was a shallow one. It would seem as if, when the medullary cavity was not exposed, the osteogenetic cells were hindered in reaching the gap from the marrow. It also showed that the periosteal new formation of bone was inadequate.

With this agrees the observations of others as to the rôle played by the periosteum in bone formation. No bone regeneration follows upon the subperiosteal excision of the scapula. In the case of the clavicle there is no regeneration except when one or both ends are left.

The pericranium as far as it covers the skull, which is developed in membrane, has no osteogenetic properties. When a graft from the tibia is inserted to fill a gap in the skull, the pericranium over it shows no osteogenesis. The graft is gradually replaced by osteoblasts invading it from the surrounding diplöe. But the base of the skull, originating in cartilage, shows a more active bone formation. Gaps in it may be filled up, the osteoblasts being derived not only from the surrounding diplöe but also from the pericranium.

The osteogenetic properties of the marrow cells may be impaired by disease, and so a cavity in a bone may only become filled with rather loose scar tissue; not only tuberculous inflammation but a new growth has this consequence. Thus a myeloid sarcoma may be scraped out of the head of the tibia and the hole then fills with loose scar tissue, continuous with the intermuscular tissue. On X-ray examination at a later stage, the hole is shown relatively transparent, whilst the septa of the bone around have undergone condensation, so as to sustain the weight, but without any new formation of bone in the cavity.

Formerly the osteogenetic property of the periosteum was overestimated; the results of so-called subperiosteal resection were uncertain. Regeneration failed when a diaphysis was hastily removed in the course of acute osteomyelitis; the patient was freed from septic absorption, but there was often no regeneration.

Regeneration tended to fail in such bones as the clavicle and fibula, and did so invariably in the case of the scapula, metacarpals, and metatarsals. Any formation of bone could be traced to the ends or to a shell adherent to the under surface of the periosteum. When, however, the dead bone of a diaphysis is not removed, it stimulates the periosteum to form an involucrum of irregular bone, in spite of the suppuration.

The **regeneration noted in muscle** is limited to an early proliferation of muscle cells upon the divided margins. If the margins are united forthwith and exactly, without the intervention of blood clot, a line of union occurs which becomes imperceptible and is separate from the surrounding structures, so that the muscle has its full function restored. Blood clot between the sutured margins is a hindrance. The subcutaneous rupture of muscle affords evidence that blood clot is no assistance to the regeneration of muscle. This constitutes a marked difference between the regeneration of muscle and that of the tendo Achillis. The muscle becomes united by scar tissue, which stretches and the function of the muscle, now divided into two shortened bellies, is much reduced. Worse still, if suppuration occurs, the gap is filled by a scar tissue, much adherent to surrounding structures and impairing still further the use of the muscle.

The restoration of the function of muscle is greatly hindered by adhesion to surrounding structures. In the case of an old-standing gunshot wound of the back of the thigh with a densely-adherent and deep scar, the hamstrings may be rendered useless. If, however, the deep scar is excised, and the hamstring muscles and their tendons dissected free, whilst preserving their vascular and nerve supply, and if at the same time the sciatic nerve and its branches are freed, much use may be regained. If the skin can be united, so as to get union, an additional restoration of function may be anticipated.

Restoration of mobility also favours the hypertrophy of the remaining portions of a muscle. Thus when the sternal portion of the pectoral is removed in amputation of the breast, if not prevented by the collection of blood clot, an exudation of lymph assumes the shape of the upper part bordering on the remaining clavicular head. This band will come to be composed partly of muscle due to hypertrophy of the clavicular portion of the pectoral, partly of fibrous tissue having the outline of the muscle. The more the muscle left, the more the hypertrophy and the greater the power regained. Should a muscle be completely excised, e.g. the sternomastoid, a fibrous band having the form of the muscle will come to occupy its place. This may then play a passive rôle in preventing deformity by the unopposed action of the opposite muscle.

The transplantation of large grafts of muscle encourages scar formation owing to the mass degenerating. The transplantation of small pieces of muscle appears to favour the filling up of a gap by causing hypertrophy of surrounding muscle along with the development of blood-vessels, also more slowly of nerves.

**Regeneration of skin.** Healing following the destruction of an area of skin is very defective. The epithelium growing inwards from the surrounding skin forms a thin epidermis on a layer of scar tissue undifferentiated from the deep scar. There is no reproduction of organized skin: neither its structure nor its function, neither its elasticity nor mobility, nor toughness nor resistance. The function of the subcutaneous tissue in serving as padding and as a cushion is badly performed by the scar tissue. In the skin the nerves of touch and of painful sensations appear the most superficial, next those of sensation of cold, and deeper those for heat and pressure sensation. The innervation of a scar of newly-formed skin takes place to only a limited extent from the margins; it is mainly due to the upgrowth of nerve fibres from below; the more extensive the area the more slowly does this occur; and the denser the base of scar tissue the more restricted the regeneration. The innervation is in the reverse order to the above, the development first of sensation of pressure, next of those of heat and cold and pain. True tactile sensations are only imperfectly restored. Everything which tends to lessen the depth and density of the scar and to leave a more or less supple subcutaneous tissue favours the regeneration of the vascular and nerve supply of the skin, including the nervous supply of the blood-vessels.

The epidermal grafts form the most rapid covering to granulations, and the speedy shutting off of the granulating surface from the air and external infection limits the amount of scar tissue underneath. But there is no reproduction of organized skin, and except for the advantage gained by the above covering in, epidermal grafting has the same result as if healing had been spontaneous. The transplantation of the whole thickness of skin dissected off from the subcutaneous tissue allows of a regeneration of all the structures of the skin. The chances of sloughing when the graft is transplanted at once, favours the Tagliacotian method, the pedicle being cut when a vascular union has become established. There slowly occurs in such a graft a degeneration of all the original structures composing the graft, at the same time that there ensues a new formation of epidermis, sweat glands, hair follicles and dermis, with its elastic fibres. According to the rapidity of the degeneration of the graft or actual necrosis, there follows a shrinkage and a fixation to the subcutaneous structures. The more gradual and the more complete the replacement of the original structures of the graft, the less the shrinkage and the greater its suppleness and mobility. Innervation is very slow; in the course of the following year there is a spreading inwards of nerves from the skin around.

The **regeneration of the connective tissue**, subcutaneous, intermuscular, and parosteal, may be complete, if infective processes are absent. It is a tissue especially prone to form pathological scar tissue under the influence of infection. Transplantation of pieces of fascia as grafts may prevent the formation of a subcutaneous muscle hernia, also induce complete mobility of the skin superficially, and of the muscle underneath. In the case of a subcutaneous fracture, not only the ends of the bone but the surrounding parosteal connective tissue as well as the muscles are at first involved in a mass of external callus. Yet later, after good union, all signs of this external callus disappears; the muscles regain their mobility upon the bone because loose connective tissue separates the muscles from the periosteum.

In operating, when the operation is aseptic, the parts involved may regain mobility after separation. In the neck wide excisions of tuberculous or carcinomatous glands can be followed by free mobility, especially when no drainage tube is kept in to act as a foreign body. Of late years Bier has had much success with the treatment of tuberculous glands by sunlight and artificial light. When absorption has taken place, free mobility is regained in the subcutaneous and intermuscular cellular tissue.

An excessive amount of scar tissue is produced when wounds are plugged with gauze: buried non-absorbable sutures and drainage tubes kept in for a long time become surrounded by scar tissue.

**Regeneration in connexion with serous and synovial membranes.** Bichat's cellular system included the connective tissue networks enclosing clefts and cavities, which could be best demonstrated when dissecting by inflating with air or by injecting water. The cavities of the cellular system included those in which were the lungs, intestines, or testes. The cellular network was especially elastic, as seen in the case of the axillary fascia. Being interposed between the vessels and nerves, it permitted of free mobility. Even such organs as the kidneys or spleen had a slight mobility in accommodation with the movements of the body. In the case of Tenon's capsule, a cellular membrane serves the purpose of a synovial membrane.

Bichat distinguished his synovial system by the synovial fluid found in joints, tendon sheaths, and bursae. The synovial fluid differed from the serous body fluid by showing no increase in dropsy. But serous and synovial surfaces were alike in being smeared with a slippery fluid.

More recent observations tend to distinguish a serous cavity lined by endothelium from synovial cavities bounded by flattened cartilage and connective tissue cells which are not true endothelium. Also synovia differs from serum in containing a material identical with or allied to mucin.

The formation of synovia is independent of use, for it is found in excess in the foetus and is abundant in joints kept at rest. Although there are no synovial glands, yet the old view that it was a secretion has some basis in fact. There is not, however, any sharply dividing line. When an adventitious bursa forms in cellular tissue from slight irritation, the fluid contains a mucin-like body, as does synovia. If there is severe inflammation the fluid is fibrinous. Cellular tissue and serous clefts and cavities are particularly prone to infection, which tends to impair mobility by the formation of adhesions and inelastic masses of scar tissue. On the other hand cellular tissue, when not inflamed, may regenerate and regain elasticity so that mobility may be restored in the case of the intestines, lungs, or muscles. Both mechanical and chemical irritation is harmful as tending to produce scar tissue even in the absence of infection. The true fluids favouring regeneration of cellular tissue and a restoration of mobility are the circulating blood and lymph fluids. Hence hyperaemia to a limited extent favours true regeneration. But stagnant blood serum, serous fluids, and fibrin favour cicatricial formation. Hence, when hyperaemia passes on to inflammation it becomes antagonistic to true regeneration.

**Regeneration in joints.** Ankylosis occurs when in arthrodesis of a paralytic joint both cartilaginous surfaces are removed. In the case of open reduction of a congenital dislocation of the hip, even when only the cartilage of the acetabulum is removed, in the course of enlarging it, whilst the head of the femur remains covered with cartilage, yet upon reduction ankylosis may set in. This may be favoured by the pressure which keeps the joint surfaces in contact. Ankylosis between joint surfaces covered by cartilage may follow the insertion of a foreign body such as a nail, or the injection of a solution of iodine.

In order to obtain mobility after resection of a joint, soft structures have been interposed. But the synovial fluid acts as an absorbing agent on foreign bodies. Thus, when an ivory peg run through the ends of the bones crosses a joint, it becomes absorbed by the action of the synovial fluid whilst remaining unaltered where it traverses the bones. Loose cartilages are produced, after a crack in the articular cartilage resulting from a slight accident, by the synovial fluid undermining the cartilage and separating it off. The synovial fluid thus favours restoration of mobility in a joint. Hence a mildly infective process such as chronic tuberculous disease, becoming arrested, may be followed by restoration of movement. Synovia may be found in the fluid of such a joint. But a severely infective process arrests the formation of synovia, the cartilage is rapidly destroyed, and ankylosis follows.

When blood is extravasated into the knee-joint, it coagulates so that the joint, when explored shortly after an injury, is found to be distended by blood clot. A few hours later fluid blood is drawn off because the synovial fluid has dissolved the fibrin.

Movement of a joint encourages the formation of synovia and so prevents ankylosis. With the same object Bier used his band, also sunlight and dry heat. Thus in the case of acute gonorrhoeal and tuberculous inflammation, by removing pain, he rendered movement of the joint possible, and he was able to dispense with plaster of Paris cases.

Pain in a joint is set up by the removal of the articular cartilage so as to expose the bone, upon which the synovia acts harmfully, as does the gastric juice upon the wall of the stomach denuded of mucous membrane, and as does the aqueous humour upon the lens fibres when it penetrates the capsule. Synovial fluid, in the absence of toxins, can cause granulating surfaces in joints to heal over.

**Regeneration after excision of joints.** After complete excision of the knee-joint it is desirable to aim for complete synostosis between the ends of the bones. It has been very rare that mobility between the ends of the femur and tibia has proved satisfactory. When, as in the case of the elbow, mobility is desirable, a free excision of the ends of the bones has proved the most trustworthy method. The insertion of strips of muscle, fascia, or fat, whether as flaps or as free grafts, has not been successful; the tendency has been for the inserted material to be absorbed and fibrous ankylosis to follow. Foreign bodies, celluloid or other sheets, inserted to keep the ends apart, set up inflammation, leading to fixation.

Animal experiments in which joints have been partially or wholly excised and new joints established have shown that the new membrane is not a new formation of true synovial membrane secreting synovia, but is similar to that lining an adventitious bursa, which produces a serous exudation.

When the cartilaginous surfaces have been completely removed, there is no reproduction of true articular cartilage. The ends of the resected bones become covered with a smooth surface of dense fibrous tissue which may sometimes resemble fibro-cartilage, but not true hyalin cartilage. True hyalin cartilage is only regenerated when part of the cartilaginous surface of a joint is left. Hence in tuberculous disease of the knee-joint, if only the capsule is excised and much of the cartilaginous surface left, satisfactory movement may be regained.

**Regeneration of blood-vessels.** The chief process of restoring the function of the circulation in an injured part is by the development of the collateral circulation, the hypertrophy and dilatation of pre-existing uninjured blood-vessels—large and small.

The newly-formed capillaries in scar tissue regeneration are imperfectly organized blood-vessels, lacking in elasticity and in the vasomotor muscle and nerve apparatus. A vein has been engrafted after the removal of a section of an artery. The wall of the venous graft becomes thicker by means of cicatricial tissue, but it does not become as thick as the section of artery removed, nor does it become organized so as to show the structure of an artery.

**Bier, A.** Beobachtungen über Regeneration beim Menschen. *Deutsche med. Wchnschr.*, 1917, **43**, 705, 833, 865, 897, 925, 1025, 1057, 1121, 1441, 1465, 1497; 1918, **44**, 4, 145, 425, 593, 761, 929, 959, 1121, 1209, 1321; 1919, **45**, 4, 225, 257, 617, 649. W. G. S.

## CAECOSTOMY. APPENDICOSTOMY

(1) A fistula communicating with the distended caecum may be made quickly, if necessary under local anaesthesia, through a short incision in the ileo-caecal region. The caecum is fixed to the abdominal wall by a small circle of sutures and the middle of the circle punctured by the cautery. Through this a suitable catheter or drainage tube is inserted. If the opening is enlarged it becomes a caecal anus. But, however small, leakage tends to occur beside the tube.

(2) On the lines of Senn and Kader's gastrostomy operation, a cone of the caecal wall may be drawn out, the apex punctured, and a catheter inserted; then the margins of the caecal opening are turned in, so as to make the aperture valvular. The fistula should not leak beside the tube, and as soon as the catheter is removed the fistula should tend to close spontaneously.

(3) The appendix near its junction with the caecum may be adapted to form the fistulous orifice, after ligaturing the appendicular artery and cutting off the distal portion of the appendix. It is only near the junction with the caecum that the lumen of the appendix will allow of the passage of a sufficiently large catheter. The stump of the appendix continuous with a cone of the caecum may be drawn directly forwards, or be laid obliquely, so as to open at the outer angle of the abdominal wound, or a button-hole opening may be made for it distinct from the abdominal wound.

The catheter may be pushed on through the ileo-caecal valve into the ileum or up into the ascending colon, or two catheters may be passed, one directed each way.

With the object of making a communication with the ileum as well as with the colon Pringle proposed to cut off the tip of the appendix and then to insert the cut end into the ileum just above the valve. The middle of the appendix was to be fixed in the external wound and a slit made into it, through which a catheter might be passed either into the ileum or into the colon. But the ordinary appendix has not a lumen sufficient for this method; it would only be practicable if the appendix were found with a much enlarged lumen.

A. Caecostomy and appendicostomy have been more often performed for the relief of ulcerative colitis, including that due to tuberculosis and dysentery. Its adoption in the acute stage of the disease is questionable; the patients are hardly able to bear even such a slight operation, and it may be possible by means of saline infusion by the rectum or subcutaneously to carry the patient through the acute stage. In such cases, when caecostomy or appendicostomy is adopted as a last resource, success is necessarily limited to a small percentage of cases.

In chronic ulcerative colitis with motions containing blood and mucopus, also in tuberculous ulcerations and amoebic dysentery, after the failure of medical treatment to cure or to prevent relapses, the operation should be adopted before the patient is exhausted. Six months is too long a period; medical treatment should not be continued for more than three months. The chief ground for the caecostomy is the hope of an increased recovery over that under medical treatment, under which statistics show a recovery of not more than 50 per cent. It affords an opportunity for the mechanical cleansing of the colon. Soap and water should be run in at a low pressure whilst a bed-pan is placed under the patient and a tube passed through the anus. If the patient can bear it, the irrigation should be continued at each sitting until the outflow becomes clear. Additions to the soap and water are of uncertain value. Astringents combined with opium, such as the compound kino powder or tannin and opium, often tend to relieve pain and check frequent motions. Perchloride of iron may be added to diminish haemorrhage. Commencement should be made with small doses.

B. Caecostomy and appendicostomy have been adopted for obstruction in the colon, simple or malignant, which cannot be removed, as an alternative to setting up an artificial anus. It has succeeded when there is only a partial narrowing of the lumen such as is produced by the cylindrical type of carcinoma in the colon and upper half of the rectum. The obstruction has in such cases become acute by a scybalous, doughy mass of faeces becoming impacted, and the distending bowel above itself develops a valvular obstruction. When the gas has escaped by the caecostomy fistula and the irrigation has dissolved the impacted faeces, the lumen of the constricted gut suffices for the passage of semifluid faeces. Thus treated, the patient is spared the burden entailed by an artificial anus. A further gain of importance is plainly demonstrated when the cylindrical mass partly obstructing the bowel is proved in course of time to be of a non-malignant character. The difficulty of distinguishing a non-malignant inflammatory mass from a malignant one arises especially in the sigmoid colon. On the other hand, caecostomy is contra-indicated in cases of irremovable annular cancer, in which the lumen of the gut is reduced to a very small communication. Also when cancer involves the lower half of the rectum and anus, the left inguinal colostomy is required to prevent all passage of faeces and so to relieve pain.

Immediately upon inserting the catheter into the caecum salt solution should be run in and siphoned back until the gut above the constriction has been emptied. After this, the catheter being kept patent, gas will escape and the return of tympanites be prevented. The colon may each day be emptied through the stricture and anus by running in soap and water, to which olive oil, castor oil, or sulphate of magnesia in small doses may be added.

It has happened that after an inflammatory mass narrowing the sigmoid flexure has subsided, the catheter in the appendicostomy fistula has been left out and the opening has spontaneously closed. This result may be compared with the state of those patients who have had an artificial anus made.

C. Caecostomy and appendicostomy have been adopted to facilitate success when excising malignant growths of the colon, by preventing post-operative tympanites owing to paralysis of the gut above the excision. As soon as motions pass regularly through the united bowel the caecal fistula is allowed to heal.

D. In late cases of perforative peritonitis in which tympanites has supervened, especially after perforative appendicitis, a catheter passed through the ileo-caecal valve and another into the ascending colon may be possibly the means of saving the patient. Gas and faecal fluid may thus be siphoned off and saline fluid run in. Much of the saline fluid will be absorbed unless the case is too late and the walls of the gut too paralysed to absorb it.

Caecostomy and appendicostomy have failed in practically all cases to afford relief in Hirschsprung's disease. Failure has also been experienced when the procedure has been tried for chronic constipation as an alternative to ileo-sigmoidostomy or to excision of the colon.

Leischner collected from German literature 135 cases in which surgical treatment had been adopted for ulcerative and dysenteric colitis.

I. 83 cases of chronic ulcerative colitis.

In one case the affected portion of the colon was excluded and connected with exterior by a fistulous opening, after which the continuity of the colon was established by suturing together the end above with the end below the excluded portion. The patient was considered cured, but 13 years later died of peritonitis following an attempt to close the mucous fistula communicating with the excluded gut.

9 cases were treated by lateral anastomosis, ileo-transversostomy or ileo-sigmoidostomy: 3 were cured, 4 improved, 1 not improved, and 1 died from intestinal obstruction.

39 cases had an artificial anus made, 21 on the left side of whom 14 were cured, 14 on the right side of whom 5 were cured, 2 in the transverse colon but both died, 1 in the lower ileum who was cured, in 1 the position of the anus was not noted; of these 39 cases 20 were cured, 8 improved, 2 not improved, 8 died, and in 1 the result was unknown.

5 cases had an invaginated caecostomy fistula: 3 were cured, 2 not improved.

23 cases were treated by appendicostomy: 14 were cured, 5 improved, 1 not improved, 2 died, and in 1 the result was unknown.

6 cases, after caecostomy or appendicostomy had failed, had an artificial anus: 2 were cured, 2 improved, 1 not improved, and in 1 the result was unknown.

II. 52 cases of severe chronic amoebic dysentery.

24 cases had an artificial anus made, 19 into the colon on the right side, 3 into the ileum, and 1 into the colon on the left side: 12 were cured, 2 improved, 1 not improved, 2 died, and in addition in 7 the result was unknown.

4 cases had an inverted caecostomy: all were cured.

21 cases had appendicostomy: 19 were cured, 1 not improved, and 1 died of tuberculosis.

3 cases, after appendicostomy, had an artificial anus: 1 was cured, 1 not improved, and in 1 the result was unknown.

Comparing the known cures among the above cases, the cures after caecostomy and appendicostomy occurred in 76 per cent.; after an artificial anus, in 50 per cent.

In Germany appendicostomy for acute ulcerative and dysenteric colitis has been practically always a failure.

**Leischner, H.** Ueber Zökalfisteln. *Arch. f. klin. Chir.*, 1918, **110**. 160.

W. G. S.

## TYPHOID AND PARATYPHOID FEVERS

In his presidential address on Enteric Fever in Flanders before the Section of Epidemiology and State Medicine of the Royal Society of Medicine, Goodall stated that the flight of the inhabitants and the rapid advance of the Germans were eminently calculated to spread enteric fever, especially as the disease was already prevalent in Belgium before the war. The nature of the country also favoured the dissemination of the disease. The whole country west of a line drawn through Antwerp and Brussels was a plain intersected with rivers, mostly canalized, canals, and ditches, the water in which could flow but slowly. This plain was in parts thickly populated and highly cultivated, and human excrement was largely used for the purposes of fertilization. The water-supply was derived, at any rate in the villages and small towns, from wells, mostly shallow. Moreover, the Belgians as a defensive measure flooded the country to the north-east of Dixmude, so that the natural stagnation was accentuated and large areas were swamped. Of the four armies engaged in Flanders only the British was at all adequately protected by inoculation. The outbreak began to assume epidemic proportions soon after the armies settled down to trench warfare in November 1914, and by the end of the year the epidemic was assuming a very serious aspect. By January and February there must have been about 4,000 cases under treatment in Dunkirk and its neighbourhood. The British army contributed comparatively few cases, only 827 up to May 1915. The bulk of the cases consisted of Belgian soldiers and civilians. The patients seen by Goodall in February, at Poperinghe, were Flemish civilians, the majority of them refugees, aged from 15 to 25, in whom the type of the disease was severe. The fever ran a very irregular course, the oscillations being frequent and extreme, so that the temperature chart at the height of the disease resembled that of a case of pyaemia or phthisis rather than enteric fever. A considerable number of the cases showed pronounced nervous symptoms, such as coma and semi-coma or restlessness and delirium. On the other hand the intestinal lesions were by no means extensive or severe. Death was due either to cardiac failure, probably caused by myocarditis, or to hypostatic pneumonia. The number of cases of intestinal haemorrhage and perforation was distinctly below the average. In March and April Goodall had the opportunity of seeing more than a hundred French soldiers at Dunkirk suffering from enteric fever, in whom the disease ran a milder course, probably for the following reasons: (1) they had been well fed and well cared for before their attack, unlike the refugees; (2) a considerable number of them had been inoculated, whereas none of the refugees had been; (3) a considerable proportion of the cases were not typhoid but paratyphoid. The severity of the epidemic as gauged by the fatality was shown in the cases in the two hospitals at Poperinghe and Dunkirk; in the former it was 21·3 per cent. and in the latter 9·8 per cent. The measures adopted for preventing a spread of the epidemic included (*a*) removal and isolation of the sick, (*b*) cleansing and disinfection of the premises, (*c*) the provision of a safe water-supply, (*d*) the compulsory inoculation of the inhabitants of the infected areas with anti-typhoid vaccine, with a punishment of deportation for refusal. Between February 1915 and May 1916, 26,700 were inoculated. The epidemic was on the wane in the middle of March 1915, and by the beginning of the summer it was at an end, not only among the armies but also in the civilian population.

As Rathery, Joltrain, and others have shown (vide *Medical Supplement,* 1918, **1**, 217 *b*), epidemics of combined typhoid fever and diphtheria have occurred several times during the war. Bonnamour has seen four examples of this association of diseases, and confirms these writers' statements as to the gravity of the condition, as three of his four cases proved fatal. In the epidemic at Zuydcoote reported by Rathery the mortality among 109 cases was 29 per cent., or three times that of ordinary typhoid. The possibility of the association of typhoid fever and diphtheria should always be borne in mind, and the throat of the typhoid patient should be examined systematically, especially during an epidemic.

Typhoid fever of recent years has been remarkably rare in the United States army. Outbreaks, however, have occasionally occurred in spite of sanitary precautions and inoculations. In August 1918 Bradbury published an account of four cases which occurred in a company of immunized soldiers, and in February 1919 Brown, Palfrey, and Hart reported twelve cases in a camp, all of whom had received three or more typhoid inoculations from two to twelve months previously, and six cases in men who had received no vaccine or in whom the inoculation had not been completed. The outbreak was attributed to the ingestion of virulent organisms in massive doses. A similar explanation is given of an outbreak of typhoid fever among American troops in England described by Hawn, Meader, and Hopkins. In an organization consisting of 248 men 98 cases occurred, of which 40 were admitted to the base hospital at Hursley, where they came under the writers' observation. All but two were clinically typhoid. All the patients had been inoculated about eight or nine months previously, with either typhoid vaccine and paratyphoid vaccine or triple typhoid vaccine or both, and many of them had received several doses in excess of the required number. It was not likely that the vaccine was at fault, since it came from many and various sources. The most probable explanation of the high incidence of the disease was the fact that the men had been closely aggregated on board ship, and that there had therefore been abundant opportunities for massive and repeated infections to occur. Of the 38 cases, 27 were much more severe than would be expected in men who had been inoculated, the reason for this being the advanced stage of the disease on admission to hospital. The average duration of the fever was over 35 days, the shortest case lasting 19 days and the longest 58 days. Five deaths occurred, a mortality of 13·15 per cent., death being due to toxaemia in 3 cases, to pneumonia in 1 case, and to surgical shock following operation for perforation in 1 case.

The subject of pleurotyphoid, as typhoid fever ushered in by pleurisy is called, is discussed by Mondolfo, who states that the first case of this kind was recorded by Lecorché and Talamon in 1881. Rendu and Gennes, in 1885, were the first to isolate the typhoid bacillus from a pyopneumothorax in a typhoid patient. Similar cases were recorded by Valentini (1889), Loriga and Pensuti (1890), and Mya and Belfanti (1898). Authorities differ as to the frequency of pleurisy in typhoid fever. Liebermeister found it in 4 per cent. of his typhoid cases. Some writers give lower figures varying from ½ to 2 per cent. (Lears, Fraenkel, Louis, McCrae, Lesné and

Ravaut), while others reckon it to be as high as 14 per cent. The male sex is most affected, as 10 out of 11 cases collected by Labiche, and 18 out of 19 collected by Remlinger, were males. In the great majority of cases the pleurisy is situated on the left side, this localization being attributed to the neighbourhood of the spleen, the chief habitat of typhoid bacilli. In support of this view Labiche cites Merklen's case in which purulent pleurisy in typhoid was accompanied by a splenic abscess.

Pleurisy usually occurs towards the end of typhoid (Charrin and Roger, Fernet, Dineur, Weintrand, Menetrier, Achard, Remlinger, Sacquépée), or in convalescence (Loriga and Pensuti, Warburg, Remlinger, Siredey, Dopter), and pleurotyphoid properly socalled is comparatively rare. Mondolfo's case was that of a soldier, aged 38, who was admitted to hospital with signs of a right pleural effusion. The constitutional disturbance was severe and delirium was a pronounced feature. Bacteriological examination of the blood and Widal's reaction were both negative on the sixth day of disease, but positive results were obtained on the twelfth day. In the second and third weeks characteristic symptoms of typhoid fever developed, such as enlargement of the spleen, epistaxis, and intestinal haemorrhage. The disease lasted eight weeks in all and ended in recovery. The case thus confirmed the general rule as to the prognosis in such cases, the outlook being all the more favourable the earlier the pleurisy develops. On the other hand, when the pleurisy appears at the height of the disease and especially in convalescence, there is a greater tendency for the effusion to become purulent. Examination of the pleural fluid in Mondolfo's patient showed a pure culture of typhoid bacilli, as in the cases reported by Loriga and Pensuti, Charrin and Roger, Fernet, Weintrand, Achard, Remlinger, Dopter. More frequently the typhoid bacillus in the pleural fluid is associated with staphylococci or pneumococci, or staphylococci and streptococci. Cytological examination in such cases is of value, as the presence of polymorphonuclear and endothelial cells in excess indicates that the pleurisy is of typhoid origin (Levy and Widal). Some writers maintain that the presence of typhoid bacilli in the pleural fluid prevents its agglutinating, but Widal has found that the fluid possesses a definite agglutinating power which is sometimes equal but more frequently below that of the blood serum, and similar results have been obtained by Finley. Étienne (1) states that though profuse sweating is frequent in paratyphoid fever, as he has noticed it in 36 per cent. of his cases of paratyphoid B, it is very exceptional in typhoid. The sudoral form of typhoid fever described by Jaccoud is now generally regarded as having been paratyphoid. Étienne however has recently observed a genuine case of the sudoral type of typhoid in a girl aged 18 who had never been inoculated against the disease. The typhoid bacillus was cultivated from the blood, and the agglutination test was positive with this bacillus in a dilution of 1 in 200.

Étienne (2) records seven cases of febrile gastric derangement caused by typhoid or paratyphoid bacilli, and characterized by a sudden and occasionally violent onset, a period of advance in which gastro-intestinal symptoms predominate, accompanied by constitutional disturbance which is usually of short duration but is exceptionally more prolonged, and a period of decline by a more or less definite lysis. The condition is not an attenuated form of enteric fever, but is distinguished from it by its sudden onset, and absence of rose spots, the typhoid state, marked prostration or characteristic diarrhoea. It should rather be regarded as a mild gastro-intestinal infection which is characterized by a short septicaemic stage without elimination of the organisms either through Peyer's patches or the skin, a circumstance which accounts for the absence of diarrhoea and toxic symptons due to absorption, and also for the absence of rose spots.

Nosologically febrile gastric derangement should be grouped with catarrhal jaundice and acute gastro-enteritis, which are often caused by the same micro-organisms.

In an epidemic of enterica described by Paton which broke out amongst the German prisoners interned at Meadi near Cairo, four of the 21 cases were classified as pseudo-paratyphoid fever. In three cases motile coliform organisms were obtained from the blood resembling the paratyphoid group in all respects except agglutinating properties. In the fourth case a similar organism was grown from the stools. The sera of these four cases did not agglutinate stock cultures of *B. typhosus*, *B. paratyphosus* A or B, or *B. enteritidis* of Gaertner. The fever was of about 14 days' duration. Slight diarrhoea and abdominal pain were present in all four cases, but no splenic enlargement or rash was observed. The outbreak was traced to a German employed as a kitchen worker, from whose stools a similar pseudo-paratyphoid organism was isolated, and to another who was found to be a carrier of *B. typhosus*.

Involvement of the nervous system in enteric fever has recently received attention from several French writers. Faroy records a case of transitory Claude Bernard-Horner syndrome (diminution of the palpebral fissure, enophthalmos, and myosis) confined to the right eye in convalescence from typhoid fever in a man aged 24. The other symptoms were flushing of the face and profuse sweating, suggesting involvement of the sympathetic in the lower cervical or mediastinal region. All the symptoms disappeared in the course of a few weeks. The presence of Kernig's sign in typhoid fever, is discussed by Audibert and Nalin, who state that it is found in more than half the cases of typhoid. It appears at the onset of the disease and does not as a rule disappear until convalescence. It is rarely absent in severe attacks, except perhaps in the adynamic forms in which the system is no longer capable of any reaction. It is also found in typhoid without any nervous localization, in the very mildest forms of the disease. In some cases it is not accompanied by any meningeal reaction, and the cerebro-spinal fluid is absolutely normal. The sign is attributed to an irritation of the cerebro-spinal motor system by the typhoid toxins.

In an article on hysterical camptocormia (bent back) and typhoid spondylitis Chiray and Roger state that though most of the cases of camptocormia so frequently seen in soldiers have followed a trauma, they have observed a certain number of non-traumatic origin among which enteric fever had recently occurred. A transitory typhoid spondylitis may give rise to a persistent camptocormia lasting from eighteen months to four years after the onset of the symptoms. Typhoid spondylitis principally affects one or two intervertebral disks, and to a lesser degree the vertebral periosteum in the neighbourhood of the disks and the periarticular tissues and ligaments. The vertebral lesion reacts on the spinal roots and to a slight extent upon the spinal cord. The patient adopts the attitude in which he suffers least, which is one of vertebral flexion. As the spondylitis subsides a return to the normal occurs in most cases, but in the neuropathic subject the spinal deformity may persist.

Treatment is the same as for other forms of hysterical contracture. During the acute stage rest in bed, continuous extension, and a plaster jacket are required, but at a later period, when hysterical contracture alone is present, the only treatment indicated is counter-suggestion, and all orthopaedic apparatus should be discarded.

Tassone classifies the osseous complications of typhoid fever into four groups according to the intensity of the process: (1) rheumatoid pains which may end in spontaneous resolution; (2) acute osteoperiostitis characterized by general symptoms and local changes. In slight cases the periosteum alone is affected, while in severe attacks the inflammation extends to the bone marrow and causes a true osteomyelitis followed by necrosis; (3) a chronic suppurative form with a late onset and slow course like that of a cold abscess; (4) a chronic non-suppurative form with a tendency to the formation of exostoses.

Lemierre and Taberlet record a case of suppurative thyroiditis due to the paratyphoid A bacillus. The patient was a soldier, the subject of goitre, who was admitted to hospital with a febrile disease complicated by pulmonary congestion which was at first regarded as influenzal. Owing to the persistence of the fever in spite of the disappearance of the signs in the lungs, the possibility of acute tuberculosis was considered. Suppuration, however, took place in the goitre, and rapid recovery followed evacuation of the pus, from which a pure culture of the paratyphoid A bacillus was obtained. The patient's serum was found to agglutinate the paratyphoid A bacillus in a dilution of 1 in 200.

The value of anti-typhoid inoculation in the Royal Navy is well illustrated by Bassett-Smith's report, in which it is stated that from October 1, 1917, to September 30, 1918, 20,910 men were inoculated with the triple typhoid vaccine, 1,486 being given one inoculation, and 19,424 two inoculations. During this period the number of enteric cases was 96, consisting of 79 typhoid, 6 paratyphoid A, and 11 paratyphoid B cases. The enteric incidence and mortality in relation to inoculation are shown in the following table:

| | Typhoid. | Paratyphoid A. | Paratyphoid B. |
|---|---|---|---|
| Inoculated once . . | 6 | — | 2 |
| ,, twice . | 12 | 2 | 2 |
| Not inoculated . . | 61 | 4 | 7 |
| | — | — | — |
| | 79 | 6 | 11 |
| *Deaths.* | | | |
| Inoculated twice . | 1 | — | — |
| Not inoculated . . | 5 | 1 | — |
| | — | — | |
| | 6 | 1 | |

Of the 12 typhoid cases who had been inoculated twice, in 9 over two years had elapsed since the last inoculation, but in one the period was only ten months, and this case was fatal. Of the two paratyphoid A cases one had been inoculated six weeks before, and one a little over a year, showing comparatively slight protection from this form of the disease. Both the two paratyphoid B cases had been inoculated over two years previously. These results show that the protection from typhoid and paratyphoid B is good, but that at least two inoculations are required, and that re-inoculations should be made not later than eighteen months.

In an article on the reaction of leucocytes after vaccination with the United States Army triple lipovaccine Wheeler Smith, Junr., points out that French investigators found that inoculation with the various T. A. B. vaccines, whether given subcutaneously or intravenously or whether ether-killed or heat-killed, was followed by the rapid appearance of a polymorphonuclear leucocytosis which reached its maximum within from four to eight hours and disappeared within forty-eight hours. In some cases it was followed by a slight leucopenia with a relative mononucleosis. Wheeler Smith's own observations were made on eighteen healthy young men who were inoculated with 1 c.c. of triple typhoid lipovaccine. Total leucocyte and differential counts were made for four days prior to vaccination and for fifty-six days after vaccination. It was found that subcutaneous injection of the vaccine was succeeded by the rapid development of polymorphonuclear leucocytosis, which gradually disappeared during a period of from four to six days and then reappeared for a period of seven to fourteen days. In exceptional cases the initial leucocytosis and the secondary leucocytosis, one or both, were followed by a mild degree of leucopenia with mononucleosis; in most cases, however, inoculation did not lead to diminution in the number of the leucocytes or of the percentages of polymorphonuclear neutrophils, but on the contrary actually induced a polymorphonuclear neutrophil leucocytosis of varying degree over a period of approximately two weeks.

In his Paris thesis on typhoid and anti-paratyphoid inoculation during the war Zivy points out that though large doses of the vaccine are well tolerated by healthy subjects, this is by no means the case in persons who present some morbid taint. The reaction in such cases depends on the amount of the vaccine injected, and it is therefore advisable to give at first a small dose. As ordinary doses of the vaccine rouses tuberculosis into fresh activity, Zivy treated cases in which this disease was suspected with small doses and in the great majority of cases was able to continue the inoculations. In persons with a history of simple or muco-membranous enteritis the inoculation was followed by a recrudescence of the intestinal symptoms and a rise of temperature. In a case of chronic hepatitis a febrile reaction and clay-coloured stools occurred. In two cases with a history of malaria the temperature after vaccination rose to 102·2 and 104° F. respectively, but a further rise of temperature was prevented by administration of quinine before inoculation. Eight of Zivy's patients had had enteric from five to forty years previously. All of these had a rise of temperature which lasted from one to four days and was accompanied by severe constitutional disturbance. In all the cases vaccinated, sixty-three in number, a considerable increase in size of the spleen was noted. The enlargement occurred almost immediately after the injection and increased after each subsequent injection. It lasted for at least two years, and was still present in some cases at the end of four years (cf. *Medical Supplement*, 1918, **1**, 9 *b*, 130 *a*, 289 *b*; *ibid.*, 1919, **2**, 22 *a*).

In view of the rarity of complications attributable to anti-typhoid inoculation the cases reported by Bussy and Meyer respectively are of special interest. During the first five months of 1916 about 22,000 men were inoculated with T.A.B. vaccine in the sector where Bussy was ophthalmologist, and out of this number five developed ocular complications. Two were examples of albuminuric retinitis in subjects of Bright's disease, and three of corneal herpes associated with herpes of the lips and nose. Bussy concludes that before performing inoculation, especially in elderly subjects, the urine should be examined and the blood-pressure estimated.

Meyer records a case of sudden death due to oedema of the glottis after inoculation in a case of status lymphaticus. The patient, a man aged 19, was given his second injection eight days after the first. Two days later, or 50 hours after the last injection, shortly after going to bed he complained of difficulty of breathing, sprang out of bed, and fell down dead. The necropsy showed oedema of the glottis, oedema of the superficial and deep cellular tissue of the left side of the thorax, mediastinum, and neck, and considerable hyperplasia of the follicles at the root of the tongue, intestinal follicles, and mesenteric lymph glands, and enlargement of the thymus, which weighed 33 gm. There was no doubt that the oedema of the glottis was connected with the inoculation, as there was much oedema of the subcutaneous tissue in the neighbourhood of the injection, and this oedema had spread upwards to the region of the larynx. The unusual extent and localization of the oedema are attributed by Meyer to the coexistence of the status lymphaticus.

Champtaloup records the case of a sheep-shearer, aged 72, who had been a typhoid carrier for 37 years, during which time several of his fellow workers on different occasions had contracted the disease. Apart from his attack of typhoid fever in 1881, he had had no serious illnesses, and no history of gall-stones or gastro-intestinal attacks could be obtained. Very numerous typhoid colonies on MacConkey plates and in almost pure culture were obtained from the faeces on many occasions, but the urine remained persistently negative. The patient's serum agglutinated his own bacillus up to 1 in 300. He was kept under observation in an isolation hospital for four months, during which time many of the recognized methods of treatment were used without avail. He was meanwhile trained in the habits of cleanliness and instructed to report to the Public Health Department from time to time.

According to Dubs the surgical treatment of typhoid carriers is founded on two facts: (1) the presence of typhoid bacilli in the gall-bladder and (2) the discovery that the gall-bladder forms the chief habitat of the typhoid bacilli in the carrier. Spelthan collected thirteen cases up to 1916, in which typhoid carriers had been successfully operated on; in five cholecystotomy and in eight cholecystectomy had been followed by a clinical and bacteriological cure. Since then four successful cholecystectomies on typhoid carriers have been performed, three by Bircher and one by Sauerbruch. On the other hand Dubs records a case in which cholecystectomy was a complete failure, typhoid bacilli being still present in the stools three months after the removal of the gall-bladder. Other organs therefore and parts of organs, probably the bile-ducts, must serve as the receptacle of typhoid bacilli. In a postscript Dubs adds that the failure of the operation had been still further demonstrated by the fact that the patient who had been admitted to hospital again had infected another inmate with typhoid seven months after the cholecystectomy.

Rodet and Bonnamour report on 127 cases of typhoid fever treated exclusively by Rodet's serum (vide *Medical Supplement*, 1918, **1**, 384 *a*). They urge that the serum should be given as soon as possible, the best results being obtained before the twelfth day of disease. It may, however, have a favourable effect at any stage, provided the disease really is typhoid fever without any associated infection. The first injection consists of 15 or

20 c.c. The next injection is delayed until the temperature rises again, when 10 to 15 c.c. are given. The same rule applies to the third injection, which consists of 5–10 c.c. As a rule not more than three injections are required, and not unfrequently two or even one are sufficient. The serum has a favourable action both on the fever and the symptoms generally. The temperature usually begins to fall on the same evening or the next day. If the temperature is not affected after three injections one may conclude that the case is not typhoid or that there is some superadded infection. The toxic symptoms are reduced to a minimum by the treatment. Among the 127 cases there were 14 deaths—a mortality of 11 per cent. On subtracting seven cases in which advanced pulmonary tuberculosis, septicaemia, hepatic abscess, or diphtheria were present on admission, the mortality among 120 cases was 5·8 per cent., which was still further reduced to 2·9 per cent. if only the cases treated before the twelfth day were taken into account. In several fatal cases the serum had a certain effect upon the typhoid infection, though it had no power to control the superadded infection which was the cause of death, as was shown by the fact that in six autopsies the intestinal ulceration was already in an advanced state of repair or even completely cicatrized.

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## TYPHUS

An editorial note in the *Deutsche med. Wchnschr.* of March 27 states that the number of typhus cases in Germany had risen to nearly 2,000. Practitioners are therefore specially urged to think of the possibility of typhus when in attendance on any febrile disease, especially in the case of soldiers and others returning from the East. According to another note in the same journal of May 29, during the German occupation of Poland the measures taken for combating typhus, which is endemic in that country, succeeded in reducing the number of cases in March 1918 to 5,000 with 513 deaths, and in September 1918 to 600 with 54 deaths. Recently, however, there has been a great increase in the incidence of the disease, 10,000 deaths from typhus occurring mostly in Poland, Galicia, and Wolhynia.

The clinical value of the Weil-Felix reaction, the knowledge of which was for a long time almost confined to German-speaking countries, has now received general recognition. The principle of the reaction is that the serum of a typhus patient agglutinates in a high degree the bacillus X 19, an organism of the Proteus group, isolated from the patient's urine. The agglutination appears early in the disease, may occur in as high a dilution as 1 in 10,000 and more, and then diminishes, but persists after recovery from the disease for a period ranging from several weeks to several months. Normal serums or serums from persons with other diseases than typhus do not agglutinate beyond 1 in 50. A well-marked agglutination at 1 in 50 or above is generally regarded as specific of typhus. Sacquépée and Delavergne examined 14 specimens of serum from persons not suffering from typhus and found that only one gave a slight agglutination at 1 in 50 and none in a higher dilution. The serum of four patients was examined on the fifth, sixth, and eighth day (two cases). No agglutination occurred in the fifth day cases, one of the eighth day cases agglutinated rapidly at 1 in 50 but not in a higher dilution; the sixth day case agglutinated well at 1 in 750, and the second eighth day case at 1 in 1,200. The serums of six typhus patients examined at a later stage during the febrile period were all definitely positive in dilutions ranging from 1 in 600 to 1 in 15,000. After the end of the febrile period the agglutinative power was examined in four cases in the second, third, twentieth, and twenty-first months respectively. In the first two cases there was a definite agglutination at 1 in 100 and 1 in 200, and in the last two there was no agglutination whatever.

Weissenbach (1), tested the reaction in 13 cases of typhus, including two convalescents, and had only one negative result, which occurred in a fatal case examined up to the tenth day, when the agglutinative power did not exceed 1 in 40. On the other hand, he found that the serum of 40 healthy subjects or persons with other infections than typhus never agglutinated *B. proteus* X 19 in a higher dilution than 1 in 30. It was rare, however, for the reaction to be positive before the appearance of the eruption, and sometimes it was not positive until one or two days later. Its maximum was reached from the eleventh to the thirteenth days. Weissenbach regarded it of special value in cases where the eruption is not characteristic or difficult to detect, as in coloured races, and also in the detection of abortive cases during an epidemic, and in the retrospective diagnosis in convalescents in whom a diagnosis had not been made during the acute stage.

Vialatte, Collignon, and Bénard, who employed the test in about 40 typhus cases in the East, found that all the patients who were examined during the first six weeks of the disease gave a positive reaction in dilutions ranging from 1 in 250 to 1 in 10,000, whereas none of the control serums taken from normal subjects or persons with other infectious diseases, such as enteric, measles, scarlatina, or relapsing fever, gave a positive reaction, even in a dilution of 1 in 50.

Special attention has been paid to the reaction in Holland, where epidemics of typhus have recently occurred (vide *Medical Supplement*, 1919, **2**, 164*a*). Van Thienen reports a case of typhus in a girl aged 9 in whom the diagnosis was confirmed by the Weil-Felix reaction, and remarks that such cases are very liable to be mistaken for influenza. Kramer has investigated the reaction in a large number of cases of typhus at various stages of the disease and found that after the twelfth day the reaction was always positive for a varying period of time. Widal's reaction was also positive as a rule at the same time as the Weil-Felix reaction and in a lower dilution. Sometimes Widal's reaction was positive while the Weil-Felix reaction was still negative. Thus one case of typhus on the eleventh day showed a positive Widal's reaction in a dilution of 1 in 200, and a negative Weil-Felix reaction, and seven days later the Weil-Felix reaction was positive in 1 in 1,000, and Widal's reaction was positive in 1 in 200.

Ficai of Perugia has carried out the reaction in 43 cases of typhus with a positive result in all, though in seven it was not obtained until the second examination, which was made four days after the first. As the rule the reaction was positive on the fifth day; in only one case which was typical clinically did it appear later, about the end of the second week. Almost simultaneously with the substances which agglutinated *B. proteus* X 19, sometimes later, substances appeared in the serum which agglutinated the typhoid bacillus, the paratyphoid bacillus A and B, and the melitococcus. Ficai recommends that very young cultures of Proteus X 19 should be employed, as cultures a few days old are less sensitive to the action of the agglutinins contained in the blood of typhus patients.

In relating his experiences as consulting physician on duty on the Palestine lines of communication Boyd also testifies to the value of the test in the early diagnosis of typhus, which was a fairly common cause of sickness in Palestine.

The clinical significance of the test is discussed by Krause, who has had extensive experience of typhus in Russia and the Balkans. He maintains that the view of Weil and Felix that the reaction is positive in 100 per cent. of the cases is incorrect. Like every agglutination test, the reaction has its limitations and fallacies. In the first place, it may not be positive till the sixth or even the eighth day, so that it is not always of much value for an early diagnosis. Secondly, in low dilutions such as 1 in 50, which some writers regard as sufficient for the diagnosis of typhus, it may be positive without the case being typhus, the positive reaction being probably due to the individual having had the disease some years previously. Like every other test the reaction should only be taken into consideration in connexion with the whole clinical picture. Krause mentions a case in which the Wassermann reaction was strongly positive, the Weil-Felix reaction was positive in 1 in 50, the agglutination test for typhoid positive in 1 in 50 and paratyphoid in 1 in 100, whereas the case was neither typhus, typhoid, nor paratyphoid, but influenza in a syphilitic subject.

As the result of his observations on typhus in Rumania Lorenz came to the conclusion that typhus patients who had not been deloused were still liable to spread the infection by their lice three weeks after the temperature had become normal. As Rocha-Lima has proved by transmission of typhus to guinea-pigs by lice that the patient is no longer contagious after the temperature is normal, the disease can only be spread by those lice which have been on the patient during the febrile period. As lousy patients are not infectious six weeks after the temperature has become normal, it may be concluded that the louse infected with typhus does not live longer than six weeks at most.

From the end of November 1917 to the beginning of April 1918, Heuyer saw 32 cases of typhus in the ambulance at Korytza in Albania. All the patients presented the following remarkable syndrome: (1) Muscular resistance of the recti abdominis from their costal insertion down to the umbilicus. Their subumbilical portion could be easily palpated, but it was impossible to depress the recti within an irregularly quadrilateral area bounded above by their insertion into the ribs and sternum, laterally by their outer border, and below by a horizontal line passing through the umbilicus. (2) A tender spot on both sides elicited by deep pressure on the outer border of the recti at the junction of the lower and middle third of a line passing from the umbilicus to the anterior angle of the tenth rib. (3) A reflex contraction of the facial muscles, often localized to the side on which the pain was caused by pressure on the supra- and para-umbilical points. (4) A vaso-motor reflex of the face, which became red and sometimes shining and moist from a sudden secretion of sweat after pressure on the supra- and para-umbilical points. The contraction of the recti and the tender spots described were constantly present. The vaso-motor reaction in the face was found in three-quarters of the cases, and the contraction of the facial muscles in about a half. The syndrome was observed in all stages of the disease, being pre-eruptive, concurrent with the eruption when it was most pronounced, and still present two or three days after the temperature had become normal. The syndrome was probably due to an irritation of the solar plexus, the supra- and para-umbilical tender spots corresponding to the semilunar ganglia.

During the acute stage of the disease and in the forms accompanied by delirium the cerebro-spinal fluid presented the following characters: (1) Increased tension similar to that seen in definite meningitis and cerebral tumour. As the disease subsided, and in very mild forms without delirium or any meningeal reaction, the hypertension was less pronounced.

(2) The fluid was clear, but had not the 'rock water' appearance of normal cerebro-spinal fluid. (3) Excess of albumin shown by testing with nitric acid, when a thick cloud or flaky deposit was formed. (4) Leucocytosis. This was always very definite and was more intense than was sometimes found in enteric or malaria. In the acute stage and especially in the forms accompanied by delirium there was a definite predominance of the polymorphonuclears over the lymphocytes in the proportion of three to one, together with a few large mononuclears and endothelial cells. At the end of the disease or after the fall of the temperature or in very mild cases the cellular reaction was chiefly lymphocytic. Valuable diagnostic information can thus be obtained by a study of the cerebro-spinal fluid in typhus.

Lumbar puncture also possesses considerable therapeutical importance, as it causes the delirium to disappear and relieves the headache.

At a recent meeting of the Hamburg Medical Club Fraenkel stated that he had excised some roseolae during life for diagnostic purposes and found the changes characteristic of typhus present in the vessels, viz. the localized necrosis of the vessel wall and the formation of nodules limited to these areas. This finding was all the more important as the eruption was not well developed, and the Weil-Felix reaction was not definite.

The establishment of typhus by Fraenkel as a specific disease of the vascular system explains a number of symptoms which may be attributed to anatomical changes in the capillaries and the haemorrhages resulting therefrom (vide *Medical Supplement*, 1918, **1**, 249 *b*, 290 *b*; 1919, **2**, 123 *a*). The results of the capillary haemorrhages subside almost without exception. Lieben records three cases of severe hemiplegia in typhus which cleared up entirely after a duration of several weeks.

In an article on the leucocyte count in typhus Weissenbach (2) alludes to his previous articles on this subject (vide *Medical Supplement*, 1919, **1**, 132 *b*, 210 *b*), and records his investigations on ten cases in which 35 examinations in all were made at various stages of the disease. In the seven cases of moderate severity which recovered, the leucocyte count during the height of the disease was characterized by a hyperleucocytosis, with a moderate neutrophil polymorphonucleosis (82 per cent. on the average) and a disappearance of the eosinophils and basophils. It should be noted that none of these patients had any concurrent infection or suppuration. In three fatal cases in which death was due to aggravation of the general condition with a high temperature and tachycardia, the blood count several days before death was characterized by a hyperleucocytosis (30,000 per cm.) and a high neutrophil polymorphonucleosis. A study of the leucocytic formula in typhus is therefore of prognostic value.

Weissenbach (2) also points out that before the appearance of the eruption, and in cases in which it is very discrete or atypical as well as in dark-skinned persons, the leucocyte count may help to distinguish typhus from enteric or measles, the two diseases which are most likely to be mistaken for it, but are characterized by leucopenia when no complications are present.

The use of pyramidon in the treatment of typhus is advocated by Hahn, who treated 32 cases systematically with it with a mortality of 9·4 per cent.; of eight not so treated one died. The course of the disease in cases treated with pyramidon was much milder than usual, and severe symptoms, such as stupor and hallucinations, were considerably diminished without the circulation being prejudicially affected. The doses given were

15 grains in tablets containing 3 grains four times a day. Schurer also treated 25 cases of typhus with the same doses of pyramidon, and found that it had a remarkably sedative effect. The favourable influence on the patient's psychical condition was independent of its antipyretic action, for even when the temperature remained high the mind became clearer and the sedative action on the motor unrest and other symptoms of excitement was noted. No bad after-effects such as collapse were observed. Whether pyramidon has an effect upon the mortality could not be decided from such small figures, but only a single death occurred among Schurer's patients in contrast with a mortality of 20 per cent. in some epidemics of typhus.

Möllers and Wolff inoculated 650 persons exposed to typhus with defibrinated blood taken from patients at the height of the fever in whom the diagnosis of typhus had been made clinically by the characteristic eruption and serologically by a positive Weil-Felix reaction. In order to have a large amount of vaccine and as polyvalent as possible, the blood of several patients, usually five to eight, was mixed together and preserved with formalin. Three injections were made subcutaneously into the mammary region, 2 c.c. being given on the first day, 2 c.c. on the fourth day, and 4 c.c. on the seventh day. The writers' conclusions were as follows:

(1) Inoculation against typhus with formalin vaccine is as free from danger as anti-typhoid and anti-cholera vaccination.

(2) The inoculation is no absolute protection against typhus, but seems to diminish the incidence of the disease and to reduce the mortality.

(3) In a few cases it was possible to protect guinea-pigs who had been previously inoculated against subsequent infection with virulent typhus blood.

(4) Of the 650 persons inoculated six contracted typhus within three months, and five within 5–8 months. Only one fatal case occurred.

(5) The inoculation should be repeated at the end of three months, as experiments on animals also show that the immunity diminishes after this period.

(6) The usual measures for combating typhus, especially the war on lice, should not be neglected in the inoculated.

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## INFLUENZA

**Historical.** At a meeting of the Frankfort Medical Club on September 16, Koch quoted a description by the Turin professor, Francesco Vallerioli, of the great European pandemic of influenza in 1510 in his *Loci medicinae communes*, from which it appears that the epidemic of 1510, like that of 1918, spread from West to East.

According to Meyer, influenzal pneumonia was already known in the Middle Ages. Between 1450 and 1537 five great epidemics were observed in Italy which caused numerous deaths from pneumonia, and then as now gave rise to a suspicion of pneumonic plague. As, however, the mortality was never higher than 10–30 per cent., it is certain that the disease was not plague. The description of the disease of the epidemic of 1564 given by Wier in 1660 sounds just like that of a present-day attack of influenza. According to Codronchi (1602) many patients had diarrhoea. Kreyssig (1793) mentioned an influenzal stage preceding pneumonia as of grave import. Potter (1812) noticed the fact that children and old persons very rarely died of this peculiar inflammation of the lungs, which usually carried off young and vigorous persons. Esmarch (1821) drew special attention to the frequency of empyema. Lastly, Bertram (1842) described a diphtheroid deposit extending to the finest ramifications of the bronchi.

**Epidemiology.** Trémolières and Raffinesque record their observations on an epidemic of influenza at Besançon, where from May 1 to December 10, 1918, 1,086 soldiers were admitted to hospital with simple or complicated influenza. 100 died from pulmonary complications or secondary septicaemia, which was equivalent to an average mortality of 9·2 per cent. The incidence of the disease was subject to certain variations. From

May 1 to August 20 the number of admissions for each period of ten days ranged from 20 to 30, from August 20 to 30 it was 30, and during the first and second ten days of September it rose suddenly to 106 and 154. After a considerable drop there was a fresh outbreak in October, 149 being admitted from October 1 to 10, and 135 from October 10 to 20. In November there was a great decline in the epidemic, the number of admissions for each period of ten days falling to 56, 23, and 28, and rising to 59 in the first ten days of December. The mortality curve did not run parallel with the morbidity curve. During the period in which the disease was most prevalent, the mortality was about 10 per cent. or about the average, and it was from November 1 to 20, when the number of cases showed a sudden drop, that the deaths were most numerous, the mortality being 17 per cent. from November 1 to 10, and 26 per cent. from November 10 to 20, when the largest number of complicated cases and pneumococcal infections occurred.

An epidemic of influenza among young recruits is reported by Gouget, who emphasizes the aetiological importance of overcrowding and cold as well as the absence of acclimatization and training, to which several military epidemiologists have previously drawn attention. Of 225 cases 7 died, 6 from broncho-pneumonia and 1 from pneumonia. Bacteriological examination of the sputum, pus from empyema, and otitis always showed the pneumococcus.

According to an editorial in *Il Policlinico* of March 30, influenza began to assume an epidemic form in Rome towards the end of September 1918, the deaths from all causes on September 27 being 68, 26 of which were due to acute broncho-pulmonary affections. The mortality rose rapidly from October 1 to 10, the number of deaths from all causes ranging from 100 to 150, and from influenza from 50 to 100. The mortality increased daily until, on October 19, the maximum was reached of 260 deaths from all causes, 226 of which were due to influenza. The figures remained high until November 3, oscillating between 240 and 150, and then dropped to 84, 35, and 29, until the middle of December, when there was a slight rise again for a few days, the daily maximum reached being 84 deaths from all causes and 40 from influenza. The deaths then declined, the ordinary mortality being reached at the end of January.

In a paper on the influenza epidemic at Nuremberg from the statistical standpoint, Federschmidt states that the total number of cases notified from July to the end of December 1918 in the civilian population was 20,145. The morbidity of the epidemic in the civil population as calculated by the notifications was 6·7 per cent., but in actual fact must have been much higher, as in numerous mild cases a doctor was never called in, and many cases which were treated were not notified; 714 cases were fatal, a mortality of 3·5 per cent. Of 6,592 cases whose sexes were stated, 2,645 were males and 3,947 females. Of the 714 fatal cases, 227 were males and 487 females, so that the male sex contributed 31·7 per cent., and the female sex 68·2 per cent. of the total mortality. As the civilian population was 300,977 in 1916 and about the same in 1918, the influenza mortality in the total population was 0·29 per cent. The greater incidence and mortality among women were due to the fact that the majority of the men between the ages of 20 and 35 were away on military service. The maximum incidence occurred between the ages of 15–30 and the maximum mortality between 20 and 35. Federschmidt suggests as an explanation for this that in infants and young children the antitoxin in the bloodstream is sufficiently strong to destroy the invading organisms, while the older persons had been rendered immune from having been attacked in the epidemic of 1889–90, just as elderly persons in that epidemic had gained immunity by an attack in the epidemic of 1847.

One of the peculiarities of the present epidemic of influenza has been the rarity of the disease in infants, so that it was supposed that the newborn enjoyed a sort of immunity from it. Achard, however, has observed 32 cases below 2 years of age in the crèche at the Necker Hospital, Paris; 6 of the cases were uncomplicated and all recovered, 12 were complicated by bronchitis or slight pulmonary congestion with one death, 13 developed broncho-pneumonia with 7 deaths, and one was taken away from hospital before recovery. Achard concludes that influenza is far from exceptional in infancy and that its form and gravity vary at this age. The infant does not possess any real immunity to the disease, but is merely less exposed to contagion, the infection being usually contracted from the mother. A fatal case of influenza in a newly-born infant whose mother had contracted the disease one day before delivery is related by Abt. Death took place on the third day, and the characteristic appearances of influenzal broncho-pneumonia were found at the autopsy.

The remarkable difference in the severity of the two epidemics in the spring and autumn respectively is well shown by Hill in his article on influenza in the Grand Fleet. In the spring there were 10,313 cases, 42 or 0·4 per cent. of which were complicated by pneumonia, &c., and 4 or 0·3 per cent. died. In the autumn, on the other hand, there were 5,381 cases, of which 375 or 6·8 per cent. were complicated, and 151 or 2·8 per cent. were fatal. Of the 5,381 autumn cases 186 had also contracted influenza in the spring, and of these 3 had two attacks. Hill suggests that the earlier epidemic was caused by the influenza bacillus uncontaminated and that the later cases were due to a mixed infection with the streptococcus and pneumococcus.

**Bacteriology.** Rose Bradford, Bashford, and Wilson isolated from cases of influenza a ‘filter-passing’ virus in the form of minute rounded coccus-like bodies varying in size from 0·15 $\mu$ to 0·5 $\mu$. The organism not only could be grown from the blood, sputum, and other exudates, but could also be seen in stained films from exudates and be demonstrated in the tissues, post mortem, by appropriate methods of staining. The cultures when inoculated into animals, subdurally or intravenously, produced illness in guinea-pigs and monkeys in which the characteristic lesions of influenza were found after death. The organism was recovered by culture from the tissues of the experimental animals, and was not found in a large series of controls.

At a meeting of a Breslau medical society on November 8 Pfeiffer stated that his bacillus had been found in 112, or 51·6 per cent., of the 217 sputa sent to the Institute of Hygiene at Breslau with the clinical diagnosis of influenza. In most of the positive cases the number of *B. influenzae* was enormous, the organism being sometimes present in almost pure culture. Other cases showed a mixed infection with staphylococci, streptococci, pneumococci, and *Micrococcus catarrhalis*. The bacteriological results in the present epidemic thus corresponded exactly with those made by Pfeiffer in 1891 and 1892. Moreover, on both occasions *B. influenzae* was found in numerous sputa which had been sent to be examined from tubercle bacilli.

In a certain number of cases, especially in children, the attack of influenza had simulated tuberculosis. In 20 out of 30 cases of influenzal pneumonia *B. influenzae* was found in the lungs, bronchi, and trachea. In several cases it was also present in the brain, spleen, pleural effusion, and cerebrospinal fluid removed after death. Pfeiffer therefore concluded that *B. influenzae* was causally connected with the present epidemic.

Olsen, who is attached to the Pathological Institute at St. George's Hospital, Hamburg, found Pfeiffer's bacillus in 166 out of 220 lungs (75 per cent.) with pneumonic changes, in which the diagnosis of influenza had been made on pathological grounds, in some instances in almost pure culture. The organism was most likely to be found in recent and uncomplicated cases, but was also present in late cases including empyema, &c., which came to autopsy two or three months after the beginning of the disease. Since as a rule only one lobe of the lung was examined, the percentages of positive cases might very probably have been higher. In addition to *B. influenzae*, haemolytic streptococci and other Gram-positive and negative cocci and bacilli were found in order of frequency.

In an article on the importance of the pneumococcus in the present epidemic, Peset, Colvée, and Rincón de Arellano report the results of 135 cultures made in autopsies from 32 cases of influenzal pneumonia. Pneumococci were found in 62 per cent., Gram-negative bacilli in 5 per cent., Gram-negative diplococci in 3 per cent., *B. subtilis* in 2 per cent., staphylococci in 1 per cent., a Gram-positive bacillus in 0·6 per cent., an elliptical bacillus in 0·6 per cent., and a Gram-positive micrococcus in 0·6 per cent.

In discussing the question why it is chiefly the most vigorous persons who die of influenza, Grabisch controverts Fischer's view that it is due to the sudden liberation of endotoxins following wholesale destruction of the bacteria by the powerful defences of the organism (vide *Medical Supplement*, 1919, **2**, 73). According to Grabisch the healthy individual has not too many but too few immune bodies, and therefore only a few bacteriolysins, so that there can be no question of a sudden destruction of bacteria. So far from this being the case, cultures show that the blood is filled with bacteria. In the cachectic, ill-nourished, and debilitated, on the other hand, who are always being attacked by bacteria, there is a constant formation of immune bodies, so that when such persons are attacked by the causal organism of a specific disease, such as influenza, the toxins of that disease are rendered harmless by more or less specific immune bodies, and the disease, if it does develop at all, runs a mild course.

**Blood.** Von Becher examined the blood of 100 cases with the following results: (1) In 29 cases of uncomplicated influenza or with tracheobronchitis only 27 showed leucopenia, the lowest number of leucocytes being 2,400. There was a slight diminution of the lymphocytes. The number of the monocytes was often increased. (2) Of 29 cases with broncho-pneumonia 22 showed leucopenia and 7 leucocytosis. With one exception all the leucopenia cases recovered, and all but one of the cases with leucocytosis died. (3) Of 35 cases with croupous pneumonia alone or combined with broncho-pneumonia 20 showed leucocytosis, and 15, of which 12 were fatal, leucopenia. (4) Of 7 cases complicated by pleurisy 6 showed leucocytosis.

**Symptomatology.** Several writers, such as Meyer, Korach, and Feilchenfeld, describe a **chronic form of influenza** in which the temperature may remain raised for weeks or even months. In Feilchenfeld's cases there were no physical signs, and the condition was attributed by him to a latent inflammatory focus in a gland or a mild form of septicaemia. In other cases in which the signs in the lungs (impaired vocal fremitus, dullness, and râles) persisted unchanged for three months, Meyer regarded the condition as due to the growth of connective tissue followed by contraction and bronchiectasis with accumulation of secretion. In two of Korach's cases in which the fever had lasted two months numerous minute areas of broncho-pneumonia were found *post mortem*, which had escaped notice as they were surrounded by normal lung tissue.

Weil observed seven cases of **gangrene of the lung** within six months in the sector of the Loire-Inférieure, where he had previously not seen a case in the course of three years. Six of the cases occurred in patients who had had a severe attack of influenza with pulmonary complications a few weeks previously, and the seventh developed during an epidemic of influenza in a man who had been poisoned by mustard gas one month previously. Four of the cases were purely pulmonary, and three were complicated, the first by gangrenous pericarditis, the second by gangrenous pleurisy, and the third by serous pleurisy. The foetid sputum invariably contained an enormous quantity of spirilla, which in two instances were accompanied by fusiform bacilli. Weil thinks that the spirilla described by de Verbizier (vide *Medical Supplement*, 1919, **2**, 23 *b*), which he himself found in about half the cases of ordinary influenza, play a part in the production of pulmonary gangrene.

In an article on **influenza and heart disease** Schott of Nauheim states that with the exception of acute articular rheumatism he does not know of any infection which is the cause of so much heart disease as influenza. In his experience not only has the number of fatal cases been much greater in the present epidemic than in that of 1890–1, but the prognosis is not so favourable and the number of cases of rapid and complete recovery is not nearly so large as before. A much longer time is needed for convalescence, but whether this is due to influenzal intoxication, or to the defective food-supply, or to nervous and emotional influences cannot be definitely stated. Schott's patients consisted of persons of both sexes and various ages in private practice and also of officers and men in the 18th Army Corps, to which he is consultant. He met with a considerable number of cases, both in civil and military practice, of simple weakness of heart muscle with dilatation giving rise to severe symptoms, such as dyspepsia, a sense of oppression, fainting attacks, and lassitude. The action of influenza on the heart in the present epidemic differed from previous epidemics in which cardiac complications also occurred, in the fact that formerly they were much less numerous, did not assume so violent a character, and yielded much more readily to treatment. Schott does not remember having heard such weak heart sounds in the previous epidemic as he has in the present one. Moreover, owing to the war diet, the weakness of the cardiac muscle is complicated by gastric and intestinal affections which act unfavourably on the nervous system and circulation and render treatment more difficult.

In well-marked cases of myocardial weakness the blood-pressure as estimated by the Riva-Rocci or Gaertner instrument is often very low, especially after the fever has subsided, but usually returns to normal again in a few days. Abnormally high blood-pressures in influenza are exceptional and are usually due to other causes, especially nervous conditions.

Influenza also tends to affect the cardiac nerves, both motor and sensory, with or without involvement of the general nervous system, giving rise to bradycardia and neurasthenia. It may also affect the heart secondarily by involvement of the lungs, bronchi, and pleura, and digestive and nervous systems.

Frey maintains that the causes of circulatory failure in influenzal pneumonia are not of a cardiac nature, but are mainly associated with a change in the vaso-motor system. In the great majority of cases there is an absence of signs of venous congestion, such as enlargement of the liver, which is seen in diphtheria, or any definite changes in the heart itself. The condition is essentially a vaso-motor paralysis, the pulse being feeble and the blood-pressure low in spite of the heart sounds being loud.

Sir James Mackenzie has never seen a case of influenza in which damage was limited to the heart alone, as occurs in rheumatic fever. That pericarditis, endocarditis, and myocarditis occur along with lung complications in influenza has repeatedly been demonstrated *post mortem*, but he has never seen a patient recover with diseased valves. The weakness after influenza is not entirely cardiac in origin, but is an outcome of an injury to other systems than the heart, such as the central nervous system.

Two cases of endocarditis due to *B. influenzae* are recorded by Malloch and Rhea, who obtained a pure culture of this organism from vegetations on the aortic cusps. In neither case were blood cultures made before death, nor was the presence of endocarditis suspected. Death took place on the thirteenth and sixth days of disease respectively. In both cases extensive broncho-pneumonia was found at autopsy and was regarded as the cause of death. In the first case the recent vegetations were found on a valve already injured (probably by syphilitic infection), and in the second case the fresh lesions were also engrafted upon the site of an old inflammatory process. In addition to these two cases the writers have collected 45 examples of endocarditis occurring in connexion with influenzal infection, but in only 14 did the data given justify an absolute diagnosis of influenzal endocarditis.

Du Castel and Dufour report a case of endocarditis of the tricuspid valve which occurred in the course of influenzal broncho-pneumonia. Death took place on the thirteenth day. *Post mortem* vegetations were found on the tricuspid valve and numerous infarcts in the right lung. Owing to war conditions no cultures were taken.

At a meeting of the Medical Society of the Lyons Hospitals on March 18 Favre, Savy, and Tolot showed a patient with obliterative **phlebitis** of the inferior vena cava which had occurred on the ninth day of influenza. It was accompanied by extremely severe pain localized in the lumbo-sacral region and considerable oedema of the lower limbs. The liver and spleen were apparently normal. The collateral circulation was well marked on the abdominal wall and upper part of the thighs.

Pommy-Michaux and Boué report a fatal case of thrombosis of the inferior vena cava and common iliac veins with sudden death from embolism in a woman aged 32 convalescent from influenzal broncho-pneumonia.

The occurrence of severe **haemorrhage** in the course of influenza forms the subject of a note by Lesné, who states that epistaxis and metrorrhagia almost form part of the symptomatology, so frequently do they appear at the onset of the disease. Haematuria, purpura, and intestinal haemorrhage, of which Lesné records an example, are very rare. In exceptional cases the haemorrhage is profuse and repeated. The haemorrhages appear to be due to the vaso-dilator action of the toxins present in the blood of influenza patients and justify the use of large doses of adrenalin. Korach attributes the haemorrhages to changes in the vessels which were first described by Kuskow in 1893 under the name of **endarteritis desquamativa.** Kuskow's observations were confirmed in the present epidemic by Oberndorfer, who regards a bacteriaemic lesion of the capillary walls as the essential feature of influenzal infection. A similar change is responsible for the thromboses of the large veins and arteries which sometimes occur after influenza (vide *supra*).

Döblin states that Kantorowicz's view, which is also shared by some Spanish writers (vide *Medical Supplement*, 1919, **2**, 74), that cases with epistaxis run a milder course than others, is not confirmed by a study of a large number of cases. In a series of 100 influenza patients with epistaxis, in whom the mortality was as high as 35 per cent., about half had epistaxis, usually as an initial symptom, but in some continuing up till the time of death and not reacting to the ordinary internal styptics or injections of gelatine.

In an article on the **nervous system** in influenza, W. Harris discusses (1) the symptoms appearing at the onset, (2) complications arising during the illness, (3) sequelae. The initial nervous symptoms consist of headache and neuralgic pains in the back and limbs and thoracic and abdominal viscera. Complication includes tachycardia, polioencephalitis, meningitis, optic neuritis, retinitis, ophthalmoplegia, especially loss of accommodation, hysteroid convulsions, myelitis, Landry's paralysis, herpes zoster, local neuritis, especially brachial neuritis and sciatica, multiple neuritis, and neuralgia. The principal sequelae are loss of smell and taste, which may be permanent, progressive bulbar palsy, myasthenia gravis, epilepsy, migraine, loss of memory, and intense inertia of mind and body.

During October and the early part of November 1918, Neal saw an unusually large number of cases of epidemic meningitis, in the great majority of which influenza had immediately preceded the attack. Cultures of the spinal fluid did not show any haemoglobinophilic bacilli mixed with the meningococci. It was open to discussion whether the resistance of the individual was lowered by the attack of influenza or whether the meningococcus attained a heightened virulence through association with the causative agent of the influenza epidemic. In about 20 instances Neal saw cases with meningeal symptoms usually in convalescence from influenza. Lumbar puncture showed a clear fluid under increased pressure, and an increase in the number of cells with a preponderance of mononuclears, but no organisms by smears or cultures. The changes were thus similar to those seen in poliomyelitis or polioencephalitis. The clinical picture taken in conjunction with the findings in the spinal fluid suggested an encephalitis secondary to an attack of influenza.

Spiegel reports a case of rapid ascending myelitis which developed after an attack of influenza complicated by pneumonia in a woman aged 28 and proved fatal in four days. Histological examination showed areas of inflammatory infiltration resembling those found in lethargic encephalitis as well as areas of softening like those in acute multiple sclerosis.

Osler records a case of influenzal pneumonia accompanied by bilateral rigidity. Death took place after four days' illness. At the necropsy spinal meningitis with haemorrhage into the theca vertebralis and nerve roots was found. There was no exudate on the cortex or base except a small area on the posterior surface of the cerebellum. Sections of the lungs showed the lesions corresponding to the influenzal type of broncho-pneumonia, but Pfeiffer's bacillus was not isolated.

Maillard and Brune discuss the effect of influenza on epilepsy and of epilepsy on influenza in a paper based on their observations during an epidemic at Bicêtre. During the acute stage of influenza the epileptic seizures almost completely ceased. Thus it was found that patients who under ordinary circumstances would have had 105 seizures had only 14 during the febrile period, and even these occurred at the onset only. It seemed as if the acute infection caused a sort of drain from the brain to the respiratory tract or had a similar action to that of a fixation abscess in a severe infection. The relief, however, was only temporary. When the temperature became normal, the seizures gradually reappeared and the epilepsy continued its course as before. The inhibitory action of the acute infection upon the epileptic seizures was none the less very definite. As regards the influence of epilepsy on influenza, the epidemic was exceedingly severe owing to the frequency of complications and the high mortality. Of 63 cases, 41 were complicated by pulmonary congestion, pneumonia, or broncho-pneumonia, and 32 deaths occurred. The gravity of the epidemic was partly due to inadequate nourishment owing to food restrictions and partly to the fact that many patients were ill for several days before their illness was recognized, but the principal cause was the predisposition of the epileptics to congestion as was shown by their facies and high blood-pressure.

The **surgical manifestations** of influenza are discussed by Schmieden, director of the Surgical Clinique of Halle University, who states that in no other form of empyema is there such a rapid spread of the disease to the opposite side or such a frequent involvement of the pericardium and even of the peritoneum, the virulence of the organism probably accounting for the pleura being unable to wall off the process. Surgical complications may also develop in the trachea, where ulcer formation may occur in the mucous membrane and lead to perforation, followed by mediastinal cellulitis and emphysema, which may be a cause of death, or if recognized in time be cured by tracheotomy. Involvement of the cervical lymph glands, which has hitherto not been known as a complication of influenza, may occur on one or both sides in convalescence, frequently fairly near the midline of the neck. In about half the cases suppuration occurs which has a very chronic course. Sometimes this adenitis is the only manifestation of influenza. Suppurative parotitis is an occasional complication. Peritonitis is sometimes met with either as secondary to empyema or independently. Influenzal appendicitis was frequently seen in the Halle Clinique after tracheal influenza in the form of a mild subacute attack, which did not end in suppuration or require laparotomy. A similar condition may be found in the transverse colon, less frequently in the descending colon and sigmoid. Typical cholecystitis may be due to influenza, Schmieden having frequently seen it occur during an epidemic in persons who had never had any previous attacks, especially in children and young children in whom gall-stones were not likely to be responsible for the condition. The cholecystitis was for the most part of a catarrhal character, for operation was never required. Various metastatic complications may occur in the extremities, such as thrombophlebitis and arthritis.

The latter is usually not suppurative, but takes the form of an effusion which lasts some weeks and then subsides spontaneously. In other cases it leads to thickening of the joints and gives rise to deformity. Other complications seen by Schmieden were abscesses of the soft parts of the thoracic and abdominal walls.

Imhofer records a case of osteoperiostitis of the right frontal bone which developed three days after the temperature had become normal in a man aged 20. There was no history of trauma or of any other disease but influenza. Recovery followed evacuation of the abscess.

Beals, Blanton, and Eisendrath observed the following **abdominal complications** of the influenza epidemic in a camp: rigidity and tenderness of the abdomen due either to an acute abdominal affection or to muscle spasm from disease of the chest; pain in the right lower quadrant simulating appendicitis; peritonitis, which was found in 6 out of 140 cases of influenzal broncho-pneumonia which came to autopsy, and was undoubtedly haematogenous in origin; rupture of the rectus muscles, which was found in eight necropsies; and thrombophlebitis of the inferior vena cava or right iliac vein in 4 cases, which in 3 led to pulmonary embolism. The rupture of the rectus abdominis occurred regularly midway between the symphysis pubis and umbilicus. It was never complete, usually involved only a few fibres, and was always unilateral. It was accompanied by haemorrhage under the sheath of the muscle. The explanation of the occurrence is to be found in the fact that the localization of the infection in these muscles with consequent abscess formation so weakens the muscles that rupture occurs after violent coughing.

Hall and Dyas state that there has been an increased number of cases of acute appendicitis requiring operation at Camp Logan since the recent epidemic. In several cases the diagnosis of appendicitis which was made on admission was changed to influenza or pneumonia after a few hours' observation, the symptoms suggesting appendicitis having been probably due to participation in the acute infectious process of the lymphoid tissue of the appendix, as is often noted in tonsillitis, measles, and similar acute diseases. Probably in many cases a definite inflammation resulted which eventually demanded operation. The epidemic gave special opportunity for the development of appendicitis, but whether by reduction of general bodily resistance, by exciting a new attack in a chronically inflamed organ, by its action on the lymphoid tissues, or by infection through the blood stream, does not appear.

A case of post-influenzal perforative appendicitis in which the pulse-rate did not exceed 66 is reported by Veyrassat. Recovery followed operation.

Smith urges that during the epidemic of influenza the chest should be minutely searched for any physical signs when a suspected abdominal lesion arises. In the case of influenzal lung complications simulating severe abdominal lesions, the movement of the alae nasi, absence of dullness in the flanks, and characteristic lethargic facies of the influenza patient are often of great assistance in the diagnosis. Three types of true abdominal catastrophes may occur, viz. (1) infection of the general peritoneal cavity by organisms associated with the influenza epidemic, especially the streptococcus; (2) acute toxaemic dilatation of the stomach; (3) coincident abdominal lesions such as appendicitis in the influenzal attack or during convalescence.

The **ocular complications** of influenza are discussed by Wessely, who reports cases in children of streptococcal metastatic ophthalmia, severe plastic iritis, and embolism of the retina as sequels of influenza. He has also seen a few instances of acute conjunctivitis, herpes of the cornea, both of a mild and severe type, occasionally followed by deep ulceration, and optic neuritis. Paralysis of accommodation is frequently attributed to influenza, but is probably always due to unrecognized diphtheria mistaken for influenza.

Franke records a case of irregularity and inequality of the pupils with loss of reaction to light and accommodation which occurred after influenza complicated by encephalomyelitis. Syphilis was excluded by the absence of any history or evidence of infection and a negative Wassermann reaction in the blood and cerebro-spinal fluid. The pupils were still inequal and irregular and had not recovered their power of reaction three months after the onset.

A case of metastatic pneumococcal ophthalmia for which enucleation was performed is reported by Samperi in a patient with influenzal bronchopneumonia, who also developed a parotid abscess and multiple abscesses in the hip.

Affection of the **accessory sinuses of the nose** is discussed by Fraenkel in a paper based on post-mortem examination of 60 cases made at the Pathological Institute of the Hamburg-Eppendorf General Hospital. In only 16 cases were the sinuses found to be intact—in other words, the sinuses were implicated in about 75 per cent.; 47 of the cases occurred in males and 13 in females. The third decennium was chiefly affected (27 cases). The sphenoidal sinus was most frequently involved, in 12 cases by itself, in 15 cases with the antrum of Highmore on one or both sides, in 8 with the antrum of Highmore and frontal sinus. The antrum of Highmore was next most frequently attacked, in 8 instances independently of any other sinus. The frontal sinus was only once affected independently. The character of the morbid process was almost exclusively an exudation, chiefly of a haemorrhagic nature. Haemorrhagic effusion was found in 13 of the 35 cases of sphenoidal sinus disease, 9 times in the antrum of Highmore and 3 times in the frontal sinus. Purulent exudation was only slightly less frequent than haemorrhagic, being found 11 times in the sphenoidal sinus and antrum of Highmore cases respectively, and 3 times in the frontal sinus. Serous effusion was decidedly rarer, being present 5 times in the sphenoidal sinus, 8 times in the antrum of Highmore, and never in the frontal sinus. In a small number of cases the sinuses contained mucus. Sometimes the diseased sinus contained no fluid, and the morbid process was then only shown by the oedematous appearance of the normally thin and transparent lining of the sinus. On bacteriological examination, *B. influenzae* was easily found in 22 cases, but in only 5 in pure culture; in all the rest other micro-organisms were present, such as streptococci and pneumococci. The sinuses may be affected during the first few days of the disease, or on the other hand they may remain intact after a long and even fatal illness.

Similar evidence as to the frequency of involvement of the nasal sinuses in influenza is given by Gerber of Königsberg of 210 cases of frontal sinusitis of which the causation could be established: a 'cold' was given as the cause in 91 cases, influenza in 61 cases, and all other acute and chronic infections, injuries, &c., in 58 cases. Influenza, therefore, apart from 'colds', accounts for 29 per cent., and this figure should probably be higher, as a 'cold' is very often really influenza. In the present epidemic Gerber has not seen such severe cases of sinusitis as in the last. A severe form of fibrinous rhinitis of influenzal nature was frequently observed in children.

**Association with other diseases.** Minkowski found that influenza had an unfavourable effect upon some cases of diabetes and nephritis. On the other hand, in striking contrast with the epidemic of 1889–91, it rarely appeared to have a bad effect on pulmonary tuberculosis (vide also Tuberculosis), or on cardiac disease. Sir J. Mackenzie has had a similar experience, as he has never found that influenza injured cases of chronic cardiac disease in any way, even cases with advanced heart failure passing through the disease scathless. In an article on influenza in diphtheria and scarlet fever, Deussing states that in the diphtheria department of the Barmbeck Hospital only one of the 60 patients who contracted influenza after admission developed severe complications (broncho-pneumonia and empyema). On the other hand, the occurrence of diphtheria after influenza was a much more serious condition, of which the following examples were observed: (1) nasal diphtheria following an old or recent attack of influenza and characterized by nasal obstruction, epistaxis, sanious discharge, and much catarrh and membranous formation in the anterior and posterior nares; (2) faucial diphtheria of moderate severity often accompanied by nasal and laryngeal involvement; (3) laryngeal and tracheal diphtheria which was frequently attended by very severe complications, a large number dying of broncho-pneumonia. In the scarlet fever department 4 of the 10 cases which contracted influenza died from broncho-pneumonia and empyema.

Glaessner found that influenzal pneumonia assumes a specially severe form in malarial patients. Out of ten cases in which this association occurred only one recovered (*Medical Supplement*, 1919, **2**, 166 *b*). Dysentery patients also stood pneumonia very badly, 5 out of 8 cases proving fatal. On the other hand, cases of enteric fever, both during the febrile stage and in convalescence, showed a striking immunity to influenza. Glaessner, therefore, suggests that an injection of typhoid or paratyphoid vaccine might be given as a prophylactic against influenza.

In an article on the action of influenza on the female sexual organs, Franz states that in October 1918, 123 or about one-third of the 400 gynaecological cases in the Francis Joseph Hospital in Vienna contracted influenza. In 46 of these cases, or in 37 per cent., the disease had exercised a definite influence on the genital organs. In 30 women this was shown by an increase in genital haemorrhage in the form of menorrhagia. Patients who had had amenorrhoea for several months developed uterine haemorrhage immediately before, during, or after their attack. In only two instances did the haemorrhage present the same characters as their previous menstruation. In all the others it lasted longer and was more profuse. In a few cases the periods set in a few days too soon, or too late, or were entirely suppressed. The occurrence of genital haemorrhage or menstrual disturbance did not bear any relation to the severity of the influenzal attack.

**Influenza in pregnancy and the puerperium.** J. W. Harris summarizes as follows the results of an inquiry on influenza occurring in pregnancy, based on the statistics of 1,350 cases. (1) Pneumonia complicated influenza in about half the cases. (2) About 50 per cent. of the cases complicated by pneumonia died, the mortality being somewhat greater during the last three months of pregnancy. (3) The gross mortality of all cases was 27 per cent. (4) Pregnancy was interrupted in 26 per cent. of the uncomplicated cases, and in 52 per cent. of those complicated by pneumonia. In the fatal cases abortion or premature labour occurred in 62 per cent. Thus in 38 per cent. the patient died without interruption of pregnancy. (5) The mortality of influenza was considerably higher (41 per cent.) in cases complicated by abortion or premature labour than in those in which pregnancy was uninterrupted (16 per cent.).

In his article on influenza in the Bremen gynaecological clinique, Bley discusses the influence of the disease: (1) during the first months of pregnancy; (2) at the end of pregnancy and during labour; (3) during the puerperium. (1) In four out of 20 cases threatening abortion could be prevented by rest in bed and symptomatic treatment, although there was considerable haemorrhage on admission to the clinique. In 15 cases the abortion which was already taking place was completed by instruments. Only five cases in which the influenzal infection had subsided at the time of the abortion ran an uncomplicated course. In six cases the patients' stay in hospital was lengthened by the occurrence of broncho-pneumonia. Five cases in this group died, in four of which influenza was the cause of death. (2) Mild attacks of influenza during the last months of pregnancy and during labour showed no clinical peculiarities, and did not have any effect upon pregnancy or labour. On the other hand, in severe cases Ottow's dictum was confirmed that pregnancy and labour are a serious complication of influenza. Of 16 cases in this group two women in the eighth month of pregnancy had a severe attack complicated by broncho-pneumonia. One had a normal delivery and the other was still pregnant. In the remaining 14 the attack coincided with the onset of labour. Four died from three to thirty-six hours after admission. Three died before delivery, and three had a premature confinement in the seventh or eighth month. Three recovered. (3) In only one case did severe pulmonary complications occur during the puerperium. All the rest had a mild uncomplicated course. Complications in the form of parametritis and perimetritis described in the epidemic of 1889–90 did not occur in Bley's cases.

Strauss has recently observed 15 cases of the association of pregnancy and influenzal pneumonia. In seven cases in which the pneumonia developed after the seventh or eighth month of pregnancy all but one died, while of the eight cases in which the pregnancy was not more than seven months old only two were fatal. As regards the effect of influenzal pneumonia on labour, Frey states that it causes delivery to take place very rapidly, labour lasting only a few hours even in primiparae.

Heppner records a case of post-mortem Caesarean section following influenzal broncho-pneumonia with successful delivery of a living child. The infant, which was not quite full term and weighed 3 lb. 15 oz., died when 25 days old, the cause of death being croupous pneumonia and pleurisy. The time which elapsed between the mother's death and the delivery of the child was one and a half minutes. In a note on influenza in the puerperium Faivre states that all the cases of influenza in puerperal women admitted to a Bordeaux hospital from the invaded regions died very rapidly from oedematous broncho-pneumonia.

**Immunity.** Hoffmann and Keuper state that of their 421 patients admitted in September to November 1918, apart from 38 moribund on admission from whom no information could be obtained, only two gave a history of having had an attack of influenza in the summer. None of the hospital staff who had been attacked in the summer contracted the disease a second time.

Other examples of immunity conferred by an attack during the earlier part of 1918 are recorded by Rouquier, Hamilton and Leonard, and Maillard and Brune.

On the other hand, Spieler has seen several cases of undoubted second attacks of influenza separated from the first by intervals of two weeks to three months, the second attack being sometimes milder, and sometimes more severe than the first.

Reiche is opposed to the hypothesis frequently put forward that the comparative rarity of the disease in the middle-aged is due to immunity acquired by the epidemic of 1889–91, on the ground that there are too great differences between the two epidemics, especially an absence of nasal and gastro-intestinal symptoms in the present epidemic, of which the characteristic features are haemorrhages, cyanotic pallor, and a tendency to pleural involvement.

Shufflebotham has collected information from twenty different sources in various parts of the country all tending to show that with the exception of phosgene gas workers, who are peculiarly susceptible to disease, workers engaged in the production of poison gases have enjoyed a very high degree of immunity from influenza.

A similar immunity to the disease was found by Gregor among workers in gasworks, in a cordite factory, and in a tin mine.

**Diagnosis.** Eisner draws attention to the difficulty of diagnosis between influenza and enteric fever, especially during the early stage, owing to the slow pulse and leucopenia, which are present in both conditions. As a rule the course of the disease will decide, as in influenza a long-continued fever is unusual. Serological and bacteriological examination will also settle the matter. Lastly, the diazo reaction is positive in enteric and negative in influenza. In the first few days, however, the diagnosis is hardly possible. It is also difficult in cases of influenza with a continued fever due to severe pulmonary complications or a general infection, especially when a bacteriological or serological examination is impracticable.

Hainiss alludes to the difficulty of diagnosing influenza with a scarlatiniform eruption from scarlet fever. The onset of the eruption varies; it may appear in the first few days of the disease, disappear rapidly, and then reappear. It is chiefly found on the chest and back in the form of a pale pink or dark red punctate efflorescence in typical cases, forming islands like scarlatina variegata, the extremities being affected as well when the rash is extensive. A bright erythema is also seen on the cheeks like the hectic flush of the phthisical patient. In most cases of influenza there is merely an injection of the tonsils and palate without any swelling, but follicular tonsillitis sometimes occurs. Some help may be afforded by a study of the blood-pressure, which is considerably raised in the early stage of influenza in children, contrary to what occurs in scarlet fever.

Aradas has found that Russo's methylene blue reaction is invariably positive in influenza irrespective of the character of the attack, and therefore considers that it possesses considerable diagnostic value, whereas

Ehrlich's diazo reaction in most cases is negative. The test is performed by dissolving a gramme of methylene blue in alcohol, adding 100 c.c. of distilled water, and then filtering. Two test-tubes are taken, one containing 6 c.c. of distilled water, and the other 6 c.c. of the urine to be examined. Five drops of the reagent are then poured into each. If the reaction is positive the urine becomes green, while if it is negative the urine assumes the same blue colour as the tube containing the distilled water.

**Prophylaxis.** The prophylactic value of quinine in influenza, which has been discussed recently by several Italian writers (vide *Medical Supplement*, 1919, **2**, 167 *b*–168 *a*), is further illustrated by Camerano, who states that in a military hospital to which 612 malarial soldiers were admitted in September–November 1918, some of them in a very cachectic state, not a single case of influenza developed, although there was a violent and fatal epidemic in the district. The immunity was attributed to the rigorous quinine treatment to which the patients were subjected. According to Vico not a single case of influenza occurred among 400 malarial cases undergoing quinine treatment in the military hospital at Alba, although the disease was very prevalent in the town and almost all the staff contracted the disease and two of them died.

Dyce Duckworth, who has also more faith in the prophylactic action of quinine than of any other drug, recommends disinfection by formalin spray of railway carriages, public vehicles, and dwelling-rooms.

**Treatment.** St Clair Thomson deprecates the use of nasal sprays or lotions during the acute stage as being apt to disseminate the infection and carry it to the ear. He recommends inhalations every two or three hours of menthol ½ dr., tincture of eucalyptus 3 oz., a teaspoonful of which is put into a pint jug of steaming water. When the acute stage is past, a simple alkaline nose lotion may be employed. In the case of anosmia it is well to refrain from local applications. A long-continued course of strychnine together with general measures is more likely to be successful.

Boudreau warmly recommends the use of iodine, the value of which is due first to its action on glandular tissue in general, and especially its functional stimulation of the endocrine glands, secondly to a similar action on the lymphoid tissue, and thirdly to its remarkable tonic action on the myocardium. It also possesses a bactericidal, antitoxic, lymphagogic, and diuretic action. In severe cases with pulmonary complications Boudreau gives an average of 100 minims of tincture of iodine in the first period of 24 hours in doses of 10 minims at a time in milk, café au lait, or diluted wine. The patient can generally be made to take from 6 to 10 doses in the 24 hours. The doses should be continued the following days, if there is not a rapid improvement, and then gradually diminished until definite recovery takes place. Children should be given from 10 to 50 minims a day up to 5 years, and from 60 to 100 minims up to 10 years. Antipyretics should not be combined with the iodine treatment.

Iodine has also been used intravenously with good result in influenzal broncho-pneumonia by Baillie, who gives 20–30 minims of the tincture diluted with 9 c.c. of a 0·85 per cent. solution of salt in freshly distilled water on two or three successive days.

Blum has treated more than 250 cases with methylene blue either by mouth in doses of 20 cgm. for adults and 10 cgm. for children 4–5 times daily in cachets, pills, or gelatine capsules, or intramuscularly, adding ½ gm. of quinine hydrochloride dissolved in a little water by means of ¼ gm. of urethane for its anaesthetic effect, or intravenously (1–2 c.c. in 24 hours of a 5 per cent. solution). If given within the first 24 hours of the disease, the injection often caused the disease to abort, and in some cases with pulmonary complications the infection was arrested and rapid defervescence took place. After treatment with methylene blue relapses and complications were rare.

Loeper and Grosdidier have also given methylene blue in a fairly large number of cases in which treatment by urotropine has failed (vide *Medical Supplement*, 1919, **2**, 126 *a*), in doses of 20–30 cgm. by mouth in cachets, and obtained cures in 13 out of 20 cases of broncho-pneumonia. In four cases intravenous injections of 4 c.c. of a 2 per cent. solution were given, but the intravenous method did not appear to offer any advantages. Methylene blue exercises a sedative, antipyretic, and antiseptic effect in broncho-pneumonia, but its action is slow.

Frank and Bruhl treated 38 cases of severe influenza with novarsenobenzol with 8 deaths, or a mortality of 21 per cent. At first tablets, each containing 0·10 gm., were given by mouth three or four times daily. In some protracted forms the drug was continued for a fortnight or more, as much as 5 gm. in all being given without any bad effects. In the more severe cases intravenous injections were given in doses of 0·30 gm., repeated, if necessary, at intervals of two or three days. As a general rule the course of the disease was rapidly changed; there was a gradual but not sudden fall of the temperature, and the pallor, lividity, and cyanosis disappeared. On the other hand Massias treated five cases of severe influenza by intravenous injections of 0·30 gm. novarsenobenzol, with four deaths, and concluded that in the uncertainty as to the nature of the influenzal agent arsenobenzol could not be the treatment indicated.

Hector Mackenzie recommends musk in cases of prostration in elderly subjects. Five to ten grains may be given in a cachet, or it may be prescribed as follows: ℞ moschi gr. iii, spir. menth. pip. ♏ xv, spir. ammon. aromat. ♏ xlv, ex aq. p. r. n.

The treatment of influenza and influenzal broncho-pneumonia by **hot baths** is advocated by Köhler, who has introduced this method from Japan, where it is used in the treatment of numerous diseases. The patient is placed in a hot bath at 104–107·6° F. for 5–7 minutes, and then taken back to bed. A slight rise of temperature not uncommonly occurs immediately after the bath, but the temperature falls the same evening or the next morning to a lower level. Another rise the next evening will necessitate a further bath. The patient always feels comfortable in the bath-room when his temperature is high. Köhler has never seen any bad effects from the treatment. Its good effect is due to increased expectoration, whereby micro-organisms and their toxins are expelled. The bath also causes a great change in the distribution of the blood, hyperaemia of the skin being effected to the benefit of the internal organs. The treatment is contra-indicated in myocarditis, fatty heart, arteriosclerosis, organic nervous disease, hysteria, and neurasthenia. Glaessner has treated a number of cases of very severe influenzal pneumonia by mustard baths and mustard packs. The mustard baths were given twice daily at a temperature of 99·4° and contained 4 lb. of mustard.

**Fixation abscesses.** Wanner attributes the efficacy of a fixation abscess to its causing an intense accumulation of leucocytes, which are broken up and set free a large quantity of ferments, by which resolution of the pneumonic exudation is effected. The abscess should be incised on the third day at the latest and aseptic dressings applied until it heals. Merklen urges that treatment by fixation abscess should be reserved for serious cases. It should be carried out at a sufficiently early stage while the organism is still capable of reaction, and it is useless to employ it in very toxic and rapidly fatal forms. The objections to the method are the local pain and the necessity of incision and subsequent dressing. If the patient cannot be kept under close observation, a fixation abscess is inadvisable owing to the danger of secondary infection. The injection should be made into the cellular tissue and not into the muscle, so as to avoid extensive sloughing. In Merklen's opinion, fixation abscesses appear to be one of the best means of protecting the system against simple influenzal infection, and still more so against influenza complicated by bronchopneumonia. Commenting on Merklen's communication, Nigay states that he has entirely abandoned this method of treatment since he attended a case in which rapidly fatal gas gangrene supervened, on which occasion he was informed of another case in which amputation was required (vide also *Medical Supplement*, 1919, **2**, 169 *b*).

**Serum therapy.** Owing to the variable results obtained by the use of anti-pneumococcal serum and the advantage derived from the local applications of certain serums, anti-meningococcal serum in particular, Mauriac has tried intrapulmonary injection of anti-pneumococcal serum in cases of influenza with pulmonary complications. Although the treatment was only used in desperate cases, he was much impressed by the rapid improvement, which was shown by a sudden fall of temperature. Of 16 cases so treated, 13 recovered and 3 died. The injection was made between two ribs right into the lung, the dose given being 20 c.c. The only symptoms noted during the operation were paroxysms of coughing in about half the cases, transitory dyspnoea which occurred in a few cases, and slight haemoptysis in one case.

Encouraged by Riese's success (vide *Medical Supplement*, 1919, **2**, 76 *a*), Hosenberg has treated 32 cases, all of which were very severe, by injections of anti-streptococcal serum with only 5 deaths, in two of which the patients were moribund on admission. In the other 27 cases the success of the treatment was striking. No difference was noticed between the effect of subcutaneous and intravenous injection.

McGuire and Redden treated 151 cases of post-influenzal bronchopneumonia by intravenous injection of human convalescent serum with a total of 6 deaths, or a mortality of 4 per cent. 132 were given 3 doses or less, about two-thirds required only 2 doses, and over one-third a single injection only. The average dose was 120 c.c. Of 138 cases 83 recovered by crisis and 55 by lysis. Of 148 cases more than a half showed a normal temperature within 48 hours after the beginning of serum treatment. The febrile period was decidedly shortened, though the physical signs persisted.

Ross and Hund treated 28 cases of influenzal pneumonia or bronchopneumonia by transfusion of citrated blood obtained from persons who had recovered from the disease and gave negative Wassermann reactions. 250–500 c.c. of blood were used at a time. A 1 per cent. solution of sodium citrate was used for a dose up to 150 c.c., a 2 per cent. solution up to 300 c.c., a 3 per cent. solution up to 400 c.c., and a 4 per cent. solution for a dose of 500 c.c. One transfusion was often not sufficient, and the transfusion had to be repeated in from 12 to 24 hours, and again if necessary. The effects of the treatment were a walling off of the process, a more rapid resolution, an earlier relief of toxic symptoms, and a shorter convalescence. Complications and sequelae were practically nil.

Lesné, Brodin, and Saint-Girons treated 14 cases of influenza by intravenous injections of human plasma. The same results were obtained whether normal or convalescents' serum or the serum of the patient himself was used. In 6 cases a permanent fall of temperature was obtained either at once or in 24 hours, in 1 the temperature progressively rose, and in 7 the effect was very slight or nil. Plasma was used, as it is less toxic than serum and does not give rise to anaphylaxis.

Faivre states that the only treatment that appeared to be of any avail in the cases of broncho-pneumonia in puerperal women was autotherapy, i.e. injection of the pleural effusion or blood of the patient herself according to the method of Artaut de Vevey.

**Vaccine therapy.** Wynn maintains that prompt treatment with vaccine within a few hours of the onset will definitely abort an attack of influenza. In cases in which broncho-pneumonia is present from the first, vaccine often seems to have the same good effect as when it is injected early. An adequate dose as soon after the onset of symptoms as possible should be given. The vaccine used by Wynn contained several strains of pneumococci, streptococci, and *B. influenzae.* For an adult man he recommends a dose of 80–100 millions of each organism, for an adult woman 60–80 millions, for a child of 10 to 12 years of age 30–50 millions, and for a child of 2 or 3 years 10–20 millions. A fall of temperature after injection is almost constant. The earlier the injection, the more likely is the fall to be final. In cases injected after the second day, more than one injection is usually required. Occasionally the first dose fails to cause a drop in the temperature and a second larger dose is required.

Trémolières and Raffinesque have treated cases of influenzal broncho-pneumonia with the vaccine G, prepared at the Pasteur Institute, consisting of strains of the pneumococcus, streptococcus, *B. influenzae,* and *Micrococcus aureus,* which are the ordinary causes of pulmonary complications. It was given subcutaneously in daily increasing doses of $\frac{1}{10}$, $\frac{2}{10}$, $\frac{4}{10}$, and $\frac{6}{10}$ cm., or 600 million, 1,200 million, 2,400 million, and 3,600 million micro-organisms. In a certain number of cases the treatment was followed by a more or less rapid fall of temperature. Similarly favourable results were obtained by Joltrain and Baufle.

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J. D. R

## MALARIA

A small outbreak of tertian malaria in the Argonne in 1917 is recorded by Péhu and Cordier. Although all varieties of anopheles had been present in the Argonne, no local epidemic of malaria had occurred before the war, and in spite of the large number of colonial and North African troops. as well as contingents who had returned from Salonika, no cases were reported in the Argonne until 1917. This occurrence favours Roubaud's view (vide *Medical Supplement*, 1918, **1**, 446 a) that the presence of the three factors, man, virus, and anopheles, is not sufficient to give rise to malaria, but that special conditions are required which were probably furnished in 1917 by the large agglomeration of men and their confinement at night in warm narrow saps. The writers conclude that the danger of malaria caused by war conditions was only slight on the western front in spite of the remarkably favourable conditions for its development.

Schmalz draws attention to the danger of malaria being introduced into Germany by prisoners of war repatriated from Russia, where malaria is endemic in many districts. In one camp 1,000 out of 3,000 prisoners contracted the disease, and, owing to the lack of quinine and under-nourishment, many deaths occurred. In only a few cases could the malaria be regarded as cured. Many thousands of carriers would therefore return to Germany. Relapses would take place sooner or later, and as the anopheles was present in Germany, a spread of the disease was extremely probable.

Several writers, such as Forschbach and Pyskowski (vide *Medical Supplement*, 1918, **1**, 212 *a*) and Verzár (*ibid.*, 446 *b*), have drawn attention to the remarkable fact that persons who have suffered from tropical malaria in the summer and autumn of the previous year develop tertian fever in the subsequent spring, even when they are living in districts free from malaria. Wörner, who has frequently observed this occurrence during his three years' duty in the Balkans, offers the following explanation: (1) Attacks of tertian fever in the spring (March to June) are relapses of a primary infection which occurred in the summer or autumn of the previous year, and in many cases have been kept latent by quinine prophylaxis. (2) Attacks of tropical fever occurring between the latent tertian infection in the summer and the definite relapse in the spring should be regarded as instances of superinfection.

Eisner, writing on the same subject, agrees with Wörner, and like him rejects the hypothesis of the transformation of the tropical into the tertian parasite still supported by Laveran and his followers, who believe in the unity of the malarial parasite. The objections to the unitarian doctrine are the morphological and biological differences in the forms of the parasites, the differences in their development, and consequently the differences in the type of fever, as well as numerous epidemiological and clinical differences between tropical and tertian fever.

According to Foley and Parrot, arrest of development and infantilism of malarial origin are fairly common in natives of Algeria. During the first two years of life the dystrophic action of malaria is shown by symptoms resembling marasmus or rickets, according to the age. The child is slow in learning to walk, and the emaciation of the face, chest, and limbs is in striking contrast with the occasionally enormous development of the abdomen due to enlargement of the spleen. None of the symptoms of true rickets, however, such as bending of the ribs or enlargement of the epiphyses, are present. In older children the emaciation and abdominal enlargement persist, and the height is much below normal. About puberty the general condition improves, signs of infantilism disappear, enlargement of the spleen diminishes, and growth now becomes very rapid. In some patients, however, puberty is late, especially for such a latitude and climate. The height for a long time remains below the normal, and in some cases the arrest of development is permanent and the Lorain type of infantilism results.

A case of congenital malaria with infection of the seven months' foetus by *Plasmodium vivax* is recorded by Leger. Abortion was not due to the taking of quinine, according to the prejudice current in Guiana, that the administration of quinine in pregnancy always produces abortion or premature confinement, but to the absence of treatment, no quinine having been taken by the mother, who was suffering from benign tertian at the time of her confinement.

Moreau states that peripheral neuritis is an infrequent complication of malaria. Polyneuritis is not necessarily due to a pernicious attack, as has been maintained by some writers, but one or two attacks of moderate severity may give rise to it. There is no doubt that the emotions and strain of warfare predispose to it. It is noteworthy that whereas certain intoxications such as alcoholism or plumbism affect definite nerves, the nervous complications of malaria are not subject to any law as regards their distribution. In nine cases in soldiers recently observed by Moreau, the facial, external popliteal, and musculo-spiral respectively were affected. The onset of the symptoms may be sudden or progressive; paralysis may be preceded by a sensation of formication, numbness, and oedema. Apoplectic forms are rare; sometimes sensory symptoms predominate and sometimes motor. Korsakoff's psychosis is occasionally observed. The prognosis is always grave. If only a slight quantitative change is found on electrical examination, an almost complete recovery may be expected. In very severe cases the paralysis may extend from the lower to the upper limbs and even to the face. In exceptional instances the neuritis involves the bulbar centres and proves rapidly fatal.

After referring to the recent literature on malarial meningitis, including the articles of Massary and Tockmann (vide *Medical Supplement*, 1918, **1**, 143 *a*), Barrillon, Alliott, Appel and de Mouzon, and Commes (*ibid.*, 1919, **2**, 78 *a*), Paisseau and Hutinel report cases which show that meningitis may occur at any stage of malaria and may range in degree from a purely anatomical reaction to a complete clinical syndrome of acute meningitis, which is the usual manifestation of a common form of the pernicious attack. The writers hold that certain phenomena concerned with the nervous system in malaria should be regarded as the more or less remote sequels of meningitis. The obvious resemblance between the two protozoal diseases, malaria and syphilis, is illustrated once again as regards syphilitic meningitis and malarial meningitis. The striking fact is the absence of parasites in the blood in the course of the pernicious attack, an occurrence which Paisseau and Hutinel, as well as several other writers on malarial meningitis, have repeatedly observed. This shows that the pernicious attack is not necessarily the consequence of a massive infection of the organism with a secondary visceral localization, but that the meningeal localization has been predominant from the first.

The condition of the cerebro-spinal fluid is generally closely related to the clinical symptoms. The cellular reaction is of a very uniform type, being constituted by lymphocytes and mononuclears, and sometimes endothelial cells. The albumin content is very considerably increased, but the pressure of the spinal fluid is not raised, or only in a moderate degree.

Novak and Toman investigated the gastric juice in 200 malarial patients and found a confirmation of their supposition that a large proportion of the cases of diarrhoea was due to defective gastric secretion. Achylia gastrica was particularly frequent in patients with well-marked cachexia. 78, or 39 per cent. of the total, had achylia, but the percentage of achylia among the cachectic patients was 45 as compared with a percentage of 34 among the non-cachectic. The difference was still more pronounced when cases with severe cachexia were compared with non-cachectic cases, the frequency of achylia in the former being 60 per cent. and in the latter 30 per cent.

The autopsy in one case of achylia showed a simple non-inflammatory atrophy of the gastric and intestinal mucosa, which was regarded as a sequel of malaria rather than the result of malnutrition or as the effect of prolonged use of quinine. The writers regard it as highly probable that the digestive disturbances exercise an injurious influence on the absorption of quinine, inasmuch as the lack of hydrochloric acid reduces the solubility of quinine and the gastrogenous diarrhoea interferes with the absorption of the drug. In such cases there is a danger of doing more harm than good by the administration of quinine.

Several cases of pseudo-peritonitis simulating appendicitis have been recorded during the first attack of malaria, but the diarrhoea, diffuse character of the pain, and rapid subsidence of the symptoms soon prove that the diagnosis of appendicitis is incorrect. Trémolières and Leclerc report a similar case which occurred during a relapse of malaria. The symptoms suggested perforative appendicitis, but were predominant in the right hypochondrium, in which the liver, especially the quadrate lobe, was enlarged and tender. The symptoms subsided without operation, their localization and intensity being probably due to alcoholism and possibly also to amoebic dysentery.

In an article on Raynaud's disease of malarial origin, Samaja states that in the cases hitherto published symmetrical gangrene of the extremities precedes, accompanies, or follows the attack. A large number of the cases (14 out of 20) had contracted a severe form of malaria in the colonies. In all the cases the first attack of symmetrical asphyxia of the extremities occurred during the cold season, so that cold appeared to be an indispensable factor in the production of Raynaud's disease. On the other hand, in Samaja's case symmetrical gangrene of the extremities appeared in August and was cured by quinine in November. Although the patient had never had any malarial paroxysms and no parasites were found in the blood, the intermittent quotidian character of the asphyxia, the presence of mononucleosis, enlargement of the spleen, and effect of quinine treatment indicated the malarial origin of the condition.

Fraga and Boaventura studied the blood-pressure with Pachon's oscillometer in 84 cases of acute malaria, 63 of which were benign tertian and 21 malignant tertian. In benign tertian the average maximum tension was 14, and the minimum 7. In malignant tertian the average maximum tension was 11 and the minimum 6. During the malarial paroxysm the average maximum was 18 and the minimum 8. Hypotension in malaria, according to these writers, is due to a suprarenal lesion, which, as the writers have shown, is liable to occur in malaria (vide *Medical Supplement*, 1918, **1**, 446 *b*).

Observations on the blood-pressure in malaria have also been made by Riebold, who found with Riva-Rocci's instrument that it was often below 100 and might sink to 75–80 mm. Hg. The fall of blood-pressure is attributed by him to a specific action of the malarial parasites on the vaso-motor nerves. It is quite independent of the general state of nutrition, being found in the young and vigorous as well as in old and debilitated persons. It is also independent of the blood, as it may be associated with a normal haemoglobin content as well as with severe anaemia. In doubtful cases it may be of diagnostic value.

In chronic nephritis the fall of blood-pressure caused by an attack of malaria may exercise an unfavourable and even fatal effect on the original disease, although the kidneys themselves are not affected by the malarial poison. The atony of the vascular system probably plays the principal part in the production of oedema, which is often of the renal type, and of thrombosis.

Severe cardiac lesions are rarely seen as a complication of malaria, but the malarial organisms probably affect the nerves regulating the heart-beat, and thereby give rise to a tachycardia which may last for weeks.

Quarelli records a case of intermittent chyluria, in which filaria and bilharzia could be excluded, which occurred during malarial paroxysms due to the parasite of aestivo-autumnal fever. The pathogenesis of the condition was obscure, but it is reasonable to suppose that in malaria an obstruction of the urinary lymphatics may occur and be followed by the passage of chyle into the urine. The case is of interest not only because it is unique, but because it should make the practitioner think of malaria when treating cases of chyluria even in tropical countries where bilharzia and filaria are endemic.

Heinemann records a case of metritis and perimetritis, possibly of malarial origin, in a woman aged 40, which gave rise to intestinal obstruction. Numerous tertian parasites were found in the blood, and intramuscular injections of quinine were given with remarkable results. The temperature fell, flatus was passed the same evening, and a stool the next morning. On the third day the uterus was distinctly smaller and complete recovery took place.

Commenting on Aimé and Lochelongue's recent communication (vide *Medical Supplement*, 1919, **2**, 77 *a*), De Jong states that apart from malarial paroxysms he has found that the Wassermann reaction is in no way affected by the existence of malaria. In the great majority of cases the reaction was only positive in syphilitic subjects. On the other hand, in a considerable number of patients who had recently had paroxysms the reaction was negative. In conversation with other medical men who had lately returned from the East, De Jong learnt that their experience was similar (cf. *Medical Supplement*, 1919, **1**, 133 *a*).

Similar observations were made by Gordon Thomson and Mills, who in a series of 130 cases of malaria examined at every possible stage of the infection found only eight positive cases, and in those they were able definitely to diagnose syphilis in each case. They therefore conclude that the Wassermann reaction performed according to a recognized standard method does not give a positive reaction at any stage of malaria, and that if a positive reaction is obtained it is due either to undiagnosed syphilis or to faulty technique.

In an article entitled ‘Herxheimer's Reaction from Quinine in Malaria’, Autric states that quinine may sometimes be held responsible for malarial paroxysms just as salvarsan and mercury may cause an aggravation of the symptoms in syphilis. Old colonials who have contracted malaria many years previously frequently maintain that a moderate dose of quinine is sufficient to bring about an attack. Autric reports two cases in which the fever suddenly fell on the day on which the quinine was stopped.

Vogel records a case of quinine idiosyncrasy in a man aged 30, the symptoms appearing after two doses of quinine (the special salt is not stated), each consisting of 7½ grains, which had been given to test his tolerance for quinine. Two hours after the second dose the temperature rose to 107·6 F., the lymphocytes disappeared from the blood, and a generalized eczematous eruption developed together with a pigmentation of the skin resembling Addison's disease. The severity of the attack was shown by the strongly positive diazo reaction. A similar attack had occurred 15 months previously after a 10 days' prophylactic course of quinine.

**Diagnosis.** Abl, like Neuschloss (vide *Medical Supplement,* 1918, **1**, 133 *a*) and Schittenhelm and Schlecht (*ibid.*, 1919, **2**, 78 *a*), has used adrenalin in malaria for diagnostic purposes, having observed that a considerable reduction in size of the spleen occurs three to five minutes after injection of the drug in malarial cases, while no such reaction takes place in Banti's disease. When the liver is also enlarged it undergoes a similar change. Abl recommends that every patient before he is discharged after treatment for malaria should be injected with adrenalin before his blood is examined. Adrenalin may also be used therapeutically in malaria to expel the parasites from the spleen, but the injections should not be repeated more than four or five times owing to the injurious action of adrenalin on the intima as shown by experiments on animals.

Zondek, who has had two years' experience of malaria in a fever hospital in Rumania, records his observations on the disease as it occurs after quinine prophylaxis. Although the method reduced the number of cases to a minimum and so satisfied the military requirements for the time being. it did not prevent the subsequent development of the disease, but merely delayed it for an indefinite period and led to the occurrence of latent malaria. The number of malaria carriers therefore became very large. The latent disease was liable to be roused into activity at any time, and this was frequently brought about by infectious diseases, especially enteric fever and typhus. After quinine prophylaxis the first attack of malaria did not present the unmistakable clinical picture of the disease, but the symptoms were so variable that an erroneous diagnosis could easily be made. Cardiac disturbance in the form of palpitation and associated objectively with tachycardia and accidental bruits frequently occurred as a malarial equivalent. The prognosis was more unfavourable than in cases which had not undergone prophylactic treatment, as there was a great tendency to relapses and for the disease to become chronic. In many cases habituation to quinine necessitated combined treatment by quinine and salvarsan.

**Treatment.** According to Borchardt the requisite conditions for the successful treatment of malaria are sufficiently large doses of quinine (over 22 grains daily) for not less than eight weeks, and not too long intervals during which the drug is not taken. At the end of every course of treatment careful clinical and haematological examination should be made for signs of latent malaria, such as slight rises of temperature, mononucleosis, neutropenia, and punctation of the red corpuscles. If these symptoms are present at the end of a course of treatment, provocative methods should be employed to determine whether the disease is really cured. If attacks occur again or plasmodia reappear in the blood, quinine treatment must be resumed. Hoffmann's provocative method, which proved to be the most successful, was carried out as follows: On the first and second day the splenic region was painted with iodine, heated by electric light bulbs, and then cooled at once by a bath at 68° F. On the third and fourth days the spleen is faradized. On the fifth and sixth days the patient is made to saw wood or work in the garden for three hours. The provocative method was carried out in the morning, and the blood was examined immediately afterwards, and again six hours later. In about half the cases this method led to reappearance of plasmodia in the blood and occasionally to fresh attacks. There are no sure signs of recovery from malaria. The absence of the symptoms described above does not necessarily prove that recovery has taken place. Subfebrile temperatures during a course of quinine disappear after raising the daily dose, and as a rule are a sign of inadequate treatment.

In connexion with the provocative treatment of malaria described by Borchardt, reference may be made to the cases of latent malaria recently reported by Siegfried and Hagen respectively. In Siegfried's case symptoms of a hitherto latent malaria developed after removal of a bullet from the abdominal wall, and in Hagen's case after injection of tetanus antitoxin.

As the result of one year's experience of malaria in the Taurus, Flebbe came to the conclusion that quinine prophylaxis has no effect in tropical malaria. It is therefore useless and perhaps even injurious to insist upon it, as there is the risk of producing habituation to quinine and thereby an enfeeblement of its therapeutical action. Flebbe's curative treatment consisted in giving 22–30 grains of quinine by mouth in divided doses, or better still 7–15 grains intravenously at the height of the fever. When the temperature became normal no further quinine was given, as a cure seldom took place even after several weeks' treatment. As soon as a relapse occurred, the large doses of quinine were repeated, and arsenic was used as an after-cure.

D'Ormea reports on the use of a 1 per cent. thymol ointment in vaseline as a culicifuge for troops in malarial districts. Of 312 who had applied the ointment to their exposed parts 71 were bitten once only, and all the rest entirely escaped.

Antonino has treated more than 100 cases of malaria by intravenous injections of quinine with the following results: Of 31 cases of benign tertian none had a relapse; of 11 cases of aestivo-autumnal fever only one had a relapse. Of 24 cases which had previously had relapses at short intervals none had any further relapses; and of nine which had relapses at long intervals five had further relapses. In a certain number of cases there was a slight rise of temperature on the sixth or tenth day after injection, but no other symptoms. In the majority of cases only a single intravenous injection was given during the first febrile attack. It was rarely necessary to give two injections, and still more rarely three. The best time to give the injections was between the onset and the height of the fever. The dose consisted of 15 grains, except in the aestivo-autumnal forms, in which larger doses—18 grains—were given.

At the Section of Preventive Medicine and Pathology of the British Medical Association, Ronald Ross gave the following summary of war experience of malaria: (1) Moderate doses of quinine—between 20 and 40 grains daily for adults—suffice in the vast majority of cases to reduce both fever and asexual parasites within two or three days. (2) The sulphate, bisulphate, hydrochloride, and bihydrochloride of quinine are almost equally efficacious within narrow limits, and their elimination by the kidneys appears to be almost equal. (3) The same may be said as regards the three modes of administration. If there is much vomiting or gastro-intestinal disturbance, the intramuscular and intravenous methods must be employed. Relapses occur with about equal frequency with all modes of administration after stoppage of the drug. (4) Rest in bed and good feeding are required during the attack and for about four days after the temperature returns to normal. (5) In first attacks and in complicated and serious attacks, larger doses than those indicated above are very generally advocated.

As regards anti-relapse prophylaxis, there is a large amount of evidence that while men are taking 60 to 90 grains of quinine every week their relapses will be infrequent, especially if they are taking good food and a sufficient amount of exercise in the open air. After treatment of the initial fever or relapse cases of malaria should be kept under anti-relapse quinine prophylaxis about two or three weeks or more if further relapses occur.

Prevention of malaria by quinine even in doses of 20 grains daily is largely a failure. One must rely more on mosquito reduction and mechanical protection.

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## DYSENTERY

At a discussion on the dysenteries at the Section of Preventive Medicine and Pathology of the British Medical Association, Dudgeon emphasized the importance of the fly as a carrier of bacillary dysentery. Two years' experience of the disease in Macedonia showed that while bacillary dysentery occurred to some extent among the troops throughout the warmer months, there were two periods of the year when it was more prevalent, viz. spring to early summer, and from the late summer to the early autumn, periods when the fly pest was at its worst. Experiments proved that flies, after contact with food infected with dysentery bacilli, were capable of carrying and disseminating these bacilli for at least 24 hours. Moreover, dysentery bacilli were isolated from wild flies captured in places in which bacillary dysentery was both endemic and epidemic.

Caussade and Marbais record a fatal case of Shiga bacillus dysentery in which the bacillus was found in the blood though absent in the stools. The symptoms were those of dysentery, death occurring on the twelfth day. At the necropsy the lesions were found confined to the large intestine, being most pronounced in the rectum and less evident towards the caecum. The mucous membrane was red, swollen, and bleeding, but did not show any actual ulceration.

Marchoux brings forward the following considerations which tend to throw some doubt on the aetiological significance of the *Amoeba dysenteriae*. Even before the war he had seen a certain number of healthy carriers of *Amoeba dysenteriae* cysts, and since the outbreak of war this has become an everyday experience. British writers have shown that the proportion of 7·4 dysentery cases among 340 carriers must be much the same as that found among individuals whose intestines are free of parasites. In a recent investigation at a powder factory at Angoulême, Marchoux found cysts of *Amoeba dysenteriae* among the Annamites employed in the establishment in all the stools which he examined, although no cases of dysentery had occurred at Angoulême either among the Annamites or among the Europeans living in contact with them. On the other hand, he has seen cases clinically resembling amoebic dysentery in which it was impossible to find either amoebae or cysts in spite of repeated examinations. He concludes by suggesting that as the amoeba usually feeds on micro-organisms it carries within its vacuoles the unknown germ which is the cause of a given epidemic.

Woodcock, who has studied the incidence of amoebic dysentery in various parts of Egypt for the past two years, maintains that far too much stress has been laid upon the part actually played by flies in the transmission of the disease. Some factor other than flies is essential, viz. water—moisture and humidity—which is more important as a factor in the transmission of the disease than any number of flies. Amoebic cysts cannot stand drying, but cysts of *Entamoeba histolytica* can retain their vitality in water at least a fortnight and probably longer. Water is the principal vehicle of transmission of infection resulting by such means as drinking contaminated water, or eating uncooked moist food.

In a paper on amoebic dysentery in England, Yorke shows that there is a considerable percentage of individuals infected with *E. histolytica* among persons who have never been out of England. He found that with very few exceptions all these persons were apparently healthy, none gave a history of dysentery, and in only one were the vegetative stages of an entamoeba present. The degree of infection varies considerably among different groups of the population, e.g. among 548 children, 1·8 per cent. were infected with *E. histolytica*; among 450 men and women, 1·5 per cent.; among 1,098 young recruits, 5·6 per cent.; and among 207 lunatics, 9·7 per cent. As regards the danger of amoebic dysentery spreading in England, Yorke points out that the infection, though only recently discovered in persons who have never been out of this country, is probably of long standing for the following reasons: 1. Carriers must constantly have been entering the country before the war. 2. All the factors necessary for spreading the disease are to be found in this country. 3. Well-authenticated cases occurred before the war of acute amoebic dysentery and abscess of the liver.

Labbé (1) calls attention to the frequency with which amoebic dysentery may be overlooked and quotes illustrative cases, several of which occurred in persons who had always lived in Paris. Amoebic dysentery is much more frequent than was formerly supposed, but often appears in an unfamiliar form. In many cases there may be hardly a single characteristic attack, even at the outset, and in the chronic stage there is merely a mucous enteritis with several stools a day, associated with colic and tenderness of the intestine on palpation. The diagnosis can only be made by examination of the stools in which living amoebae or cysts are found. Such an examination, therefore, should always be made in cases of chronic enteritis. Labbé fears that after the war there will be an increase in the number of cases of amoebic dysentery contracted in France owing to the spread of amoebiasis by soldiers returned from the East.

In an article on the diagnosis of amoebic hepatitis, Ravaut and Charpin point out that though a patient may have had no history of dysentery and have never left France, and though his stools may be normal and contain no amoebae or cysts, amoebae may nevertheless be found in the liver on exploratory puncture. In some cases, however, exploratory puncture may be negative, either because the abscess is too small or because the condition is merely one of non-suppurative parenchymatous hepatitis. In such cases, purely medical treatment has such a rapid action that it forms a real touchstone of the hepatic lesion. The writers have obtained excellent results by the following therapeutic test, which should be carried out in all cases of hepatitis of uncertain nature, even if all the other symptoms of amoebiasis are absent. A series of 10 intravenous injections of novarsenobenzol is given, one every sixth day, the dose never exceeding 0·30 gm.; between each of the first four injections emetine is given for three days in succession in doses of 4, 6, and 8 cgm. The emetine is stopped between the fourth and seventh injections of novarsenobenzol, and resumed in the same doses as before after the seventh until 18 injections of emetine in all have been given. Under this treatment, in cases of amoebic hepatitis, the pain and fever disappear, the liver diminishes in size, and there is a very rapid improvement in the general condition.

Savignac and Alivisatos report a case of attacks of urticaria following injections of emetine hydrochloride for amoebic dysentery. The eruptions sometimes lasted as long as five months after the last injection. The writers attribute the occurrence to the mode of elimination of emetine, which is spread over a considerable period, and is also intermittent, which may perhaps account for the successive crops of urticaria.

In a note on dysentery in Albania, Sangiorgi shows that the forms of dysentery in this region are due to various aetiological factors, among which the dysentery bacillus predominates. The following returns were given for the year 1918: 1. Bacillary dysentery, 32 cases, 23 of which were caused by Shiga's bacillus and 9 by Flexner's bacillus, occurred among 555 prisoners (5·7 per cent.); 85 cases, 62 of which were caused by Shiga's bacillus and 23 by Flexner's bacillus, occurred among 1,794 Italians (4·7 per cent.). On adding five cases in which Shiga's bacillus was associated with *Entamoeba dysenteriae*, this bacillus was isolated 90 times and Flexner's bacillus 32 times. There was thus a considerable preponderance of Shiga's bacillus, not only over Flexner's bacillus, but over all the other factors of dysentery in Albania. 2. Protozoal dysentery: (*a*) *Amoebiasis*. 19 cases occurred among prisoners and 31, of which 5 were mixed cases, among Italians, or a percentage of 3·4 and 1·7 respectively. The largest number of cases (31) occurred during July, i.e. in the hottest days of the summer, and the rest of the cases occurred sporadically. (*b*) *Lambliasis* was unusually frequent. 63 cases occurred, the majority in the second ten days of September. It is very probable that in Albania, as Wenyon and O'Connor found in Egypt, cats are among the animals which contribute to the dissemination of the disease. (*c*) *Balantidiasis*. In exceptional cases, in addition to diarrhoeic syndromes in which *Balantidium minutum* was found, there was a form of dysentery caused by *Balantidium coli*. (*d*) *Trichomonosis and tetraminosis*. Cases of dysentery due to *Trichomonas intestinalis* and *Tetramitus mesnili* were not infrequent in Albania during 1918. Although the faeces in these cases did not present the macroscopical appearances of the stools seen in other forms of dysentery, nevertheless on microscopical examination they showed leucocytes, red corpuscles, and intestinal cells undergoing inflammatory changes.

According to Labbé (2), *Lamblia intestinalis*, which was formerly regarded as a harmless parasite, plays an important part in the aetiology of enteritis, as has been proved by outbreaks of enteritis due to this cause in the Dardanelles, Egypt, and Flanders during the war. The onset is rarely acute like that of amoebic dysentery, but insidious; digestive disturbances, diarrhoea, and pain set in gradually, and the enteritis passes into a chronic state characterized by alternate diarrhoea and constipation with expulsion of mucus. The stools are only rarely dysenteriform. Colic, tenderness of the intestine on palpation, and meteorism are less marked than in amoebic dysentery, and the disease runs its course without any rise of temperature. As a rule there is no blood or soluble albumin in the faeces, a sign that the ulceration is not very deep (vide *Medical Supplement*, 1918, **1**, 453 *a*). The disease, however, has a pronounced effect upon the general condition; the patient loses flesh and strength and becomes pale, so that pulmonary or intestinal tuberculosis may be suspected. The condition is extremely persistent and refractory to treatment. Emetine and salvarsan have no effect. Labbé has used rectal injections of silver nitrate, hydrogen peroxide and iodine, as well as calomel and thymol internally, but none of these drugs has a specific action. The intestine becomes infected by lamblia in various ways, as a rule probably by direct contagion favoured by overcrowding and dirt. Contagion can also take place indirectly by food, toilet articles, and water contaminated by faeces.

Fleming has also observed cases of lamblia dysentery at Salonika. In one of the cases lamblia cysts persisted for a long time, the patient apparently doing well, as far as the control of the diarrhoea was concerned, unless there was some indiscretion in diet, when a severe relapse of diarrhoea occurred.

In this connexion allusion may be made to a paper on intestinal lambliasis by Mantovani, who records two cases to disprove the assertion that lamblia is not pathogenic, and to show that it may give rise to inflammatory changes in the intestine ranging from catarrhal and follicular enteritis to ulcerative enteritis with perforation.

Dyspepsia as a sequel of dysentery is discussed by Loeper, who states that it usually assumes one of three forms—a flatulent form, a coprostatic form, and a painful form. The flatulent form is both gastric and intestinal. The patient feels discomfort rather than actual pain at the onset of digestion, and later presents abdominal distension, drowsiness, and a vaso-motor reaction, which is shown by flushing of the skin and acceleration of the pulse and respiration. These symptoms gradually subside, but in some cases become more pronounced in three to six hours. Radioscopy shows an atony of the stomach with hour-glass contraction.

In the coprostatic form the patient is constipated, the bowels acting only every two or three days. The painful form is characterized by attacks of intestinal cramp, which occur fairly often in the morning, sometimes four or five hours after food, and sometimes without any obvious cause, and at no definite hour of the day. On X-ray examination some parts of the intestine are seen to be distended with gas, and others contracted. Loeper attributes these forms of post-dysenteric dyspepsia to four distinct processes, viz. gastritis, enteritis, functional disturbance of the liver and pancreas, and derangement of the nervous system. Gastritis is shown by disorders of secretion and desquamation of the epithelial cells; enteritis by mucorrhoea, microscopical haemorrhages, albumin in the stools, and by a dry condition of the rectal mucous membrane on proctoscopy, and disturbance of the liver and pancreas by the increase of fatty and farinaceous residues in the stools.

In other cases the dyspepsia is due to coelialgia, i.e. an abnormal irritation of the solar plexus.

The symptoms consist of attacks of pain, spasm, meteorism, diarrhoea, and dyspepsia, and special areas of the plexus are sensitive, viz. the epigastric, superior and inferior mesenteric, iliac, and paravertebral zones.

Treatment consists not only in washing out the rectum and instituting a strict regimen, but also in ordering antispasmodics and nerve sedatives. Electrical treatment, especially high frequency, is often valuable. Lastly, a thermal cure should be undertaken, e.g. at Châtel-Guyon or Plombières.

A fatal case of intestinal obstruction following dysentery in a man aged 22 is recorded by Brüning. A faecal fistula was made, but death took place from septicaemia. The necropsy showed that the lumen of the gut at the junction of the sigmoid with the rectum was obstructed by an overgrowth of the mucous membrane. 10 cm. above the anus the overgrowth stopped as abruptly as it had begun. No glands were found in the neighbourhood of the rectum and nothing pathological was discovered in the vessels. No histological examination was made, but Brüning is inclined to regard the overgrowth as a reparatory hypertrophy. The destruction of the rectal mucous membrane was most pronounced in those parts where the infective faeces were retained longest, and in these areas the stimulus to new formation was most marked.

In an article on Boehncke's 'dysbakta' Paetsch states that writers are by no means unanimous as to its efficacy. While Bischoff attributes considerable value to it (vide *Medical Supplement*, 1918, **1**, 341 *a*), Hoffmann (*ibid.*) is less enthusiastic. The favourable reports made by Steuernagel and Sachs-Mücke (*ibid.*, 216 *a*) are not conclusive, as their inoculations were carried out in August and September when every epidemic of dysentery tends to decline spontaneously. Paetsch performed 7,700 inoculations with dysbakta at the end of May and beginning of June, and summarizes his conclusions as follows: Vaccination with dysbakta is harmless, but is accompanied by a severer reaction than anti-typhoid inoculation. Infections which are in the incubation stage can be rendered active by inoculation. The method confers a slight immunity to infection, but the morbid process in the intestine is in no way affected. The course of the disease as a whole, the duration of the diarrhoea and of the blood in the stools, and the patient's subjective symptoms, especially pain, show no difference in the vaccinated and non-vaccinated. The relative number of severe cases was 17·4 per cent. in the vaccinated and 12·7 per cent. in the non-vaccinated. On the other hand, it seemed that the vaccine afforded a relative protection against the toxic effects on the system as a whole, as shown by the duration and frequency of the fever, and especially by the frequency of the complications which occurred in 8·8 per cent. of the vaccinated and in 12·4 per cent. of the non-vaccinated. The mortality also showed a striking difference in the two groups, being nil in the vaccinated and 4·3 per cent. in the non-vaccinated. Paetsch recommends that prophylactic inoculation against dysentery should not be undertaken when an epidemic has already broken out, because it will be frequently unsuccessful owing to the short incubation period, but it is much better to carry out inoculation on a large scale in May.

The treatment of bacillary dysentery is discussed by Görner in a paper based on 2,604 cases treated by him in 1917. The best results were obtained by the use of the polyvalent Dresden and Hoechst serum, which was given in 244 cases. In most cases 60 c.c., 30 c.c., and 20 c.c. were given on three successive days, and smaller doses in milder cases. In particularly severe cases a total of 200 c.c. and more was injected. In cases treated with serum on the first or second day the haemorrhage ceased in 3·3 days. Even cases which did not receive serum until late (14th to 22nd day) were benefited. Intramuscular injection appeared to be the most suitable method. In dysenteric arthritis good results were obtained by giving large doses from the first and continuing them till an effect was produced.

In his article on the treatment of bacillary dysentery Nelli states that from 1916 to February 1919, 700 patients were admitted to the Verona isolation hospital with the diagnosis of dysentery. 693 of them were soldiers, of whom 400 were prisoners of war and 293 Italian soldiers, and 7 civilians. 500 were found to have bacillary dysentery of the Shiga type, and 200—all prisoners of war—dysenteriform enteritis. The percentage mortality among those not treated by serum was 28·60 (8 deaths among 28 admissions), and among those treated by serum 1·27 (6 deaths among 427 patients). Nelli concludes that anti-dysenteric serum constitutes an excellent remedy in every respect, as it reduces the mortality to a minimum, shortens the duration of the disease, diminishes the frequency of complications and relapses, relieves tenesmus, and reduces in a surprising degree the number of the stools. The serum was given in large doses without any ill effects. 60–80 c.c. were injected in very severe cases, and the injections were repeated in doses of 50–60 c.c. for the two following days if the condition remained serious, and with progressive improvement smaller doses were given on alternate days. In some cases 50–60 c.c. were injected at first, on the following day 30–40 c.c., and then 30 c.c. on alternate days. In moderately severe cases an initial dose of 30–40 c.c. was given, and the dose repeated in 24 hours, and then 30 c.c. were given on alternate days. In mild cases 30 c.c. were given at first, and then 30 c.c. on alternate days, if required. Nelli never gave more than three injections in succession or more than a total of five or six injections.

In his thesis on the Treatment of Suppurative Amoebic Hepatitis by Emetine without Operation, Goulven states that subcutaneous injection of emetine in a very large proportion of amoebic hepatic abscesses not only causes an arrest of the suppurative process, but also brings about an entire absorption of the pus and complete recovery. In very large collections of pus and in certain abscesses in which there appears to be little tendency to absorption emetine should be supplemented by aspiration. In almost all cases the combination of these two methods saves the patient the necessity of incision and drainage. In cases in which the abscesses have opened spontaneously and form a fistula treatment by emetine alone is almost always successful, whereas surgery as a rule is powerless. To ensure recovery the hypodermic injection of emetine must be carried out systematically. A daily dose of 0·06 gm. of emetine hydrochloride is required in moderate cases, and 0·08 gm. in severe and urgent cases, and should be continued for 8–10 days. Another series of injections should be given after an interval of 8–10 days, even in cases of apparent cure. Finally, owing to the possibility of relapses a series of 8–10 consecutive injections should be given during each of the following months in doses of 0·04 gm.

If an aspiration is made, 0·08 gm. of emetine hydrochloride dissolved in normal saline may be injected with advantage into the abscess cavity. Emetine treatment is contra-indicated under the following conditions: (1) in cases of secondary infection of the abscess. Bacteriological examination of the pus should therefore be made to detect any microbial association. Immediate incision and drainage is required in such cases: (2) in cases of transformation of the abscess into a bile-stained fluid when aspiration is generally sufficient to effect a cure. Apart from these cases operation is only indicated in (1) very severe cases in which the patient does not react to a trial treatment by emetine (three injections of 0·08 gm.), as shown by a relief of pain and settling of the temperature in 48–60 hours after the first injection; (2) in moderately severe cases where the physical signs persist or when aspiration is impossible.

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## CARDIO-VASCULAR DISEASES

In his thesis on Congenital Aortic Stenosis Paillard has collected 92 cases, 70 of which occurred in males and 22 in females. The diagnosis depends on the following circumstances: (1) A history of cardiac diseases from infancy. (2) The presence of pulsating vessels on the back and chest indicating a supplementary circulation. (3) A systolic murmur at the aortic orifice conducted towards the xiphoid cartilage or a systolic murmur in the left dorsal region. (4) A difference of blood-pressure in the upper and lower limbs. Whereas normally in the horizontal position the blood-pressure is higher in the lower than in the upper limb, in congenital aortic stenosis the reverse holds good, and the vigorous pulse in the upper limb is in striking contrast with the microsphygmia of the lower limb.

The course of the affection appears to depend upon the resistance of the cardiac muscle, the degree of stenosis, and the patient's manner of life. In 15 cases death was due to aneurysm, in 8 to rupture of the aorta, and in others it was accompanied by anasarca, violent palpitation, and cyanosis. The stenosis, however, is not incompatible with a long life, and almost all the cases reached middle age. Barrié has recorded some cases who lived to 72, 84, and 92 years of age.

A case of congenital stenosis of the left subclavian artery with a probable patency of the ductus arteriosus is reported by Laubry and Esmein (1) in a man aged 22. On examination of the main artery of the upper limb the pulse was found to be considerably weaker than in the corresponding part on the opposite side. The same degree of difference was found in the left radial, brachial, axillary, and subclavian arteries, and then the difference suddenly ceased, the pulses in the two carotids and femorals being equally strong. Similar information was obtained by estimation of the blood-pressure. With Vaquez's instrument the maximum pressure was 13 in the right arm and 9 in the left; with the oscillometer the corresponding figures were 23 in the right radial and 13 in the left, and 24 in both lower limbs. On examination of the heart a murmur was heard occupying the whole of systole, and only ceasing with the second sound, which was much accentuated at the pulmonary orifice. The area of the murmur was the first left intercostal space close to the sternum and the left upper portion of the manubrium. It was conducted upwards and to the left in the supraclavicular space and along the left cervical vessels. No compression of the artery was found on X-ray examination. Acquired arteritis was improbable in a young subject without any history of intoxication or infection and with a negative Wassermann reaction. Congenital stenosis of the subclavian artery therefore remained the only diagnosis possible, the murmur being due to persistence of the ductus arteriosus.

Willius records three cases of congenital dextrocardia in women, aged 40, 37, and 33 respectively, associated with transposition of the abdominal viscera. In no instance was there any complaint referable to the abnormality. Electro-cardiography proved a valuable adjunct in the diagnosis.

In an article on hypoplasia of the heart and vessels von Hansemann describes a form of infantilism which may affect the whole vascular system or only single parts of it, such as the vessels alone or the heart alone, the whole extent of the aorta or only the ascending aorta, or the aortic valves and sinuses of Valsalva or individual arteries supplying the brain, kidneys, suprarenals, or spleen. The infantilism may affect either the entire vessel, causing hypoplasia and giving rise to 'drop heart' with corresponding changes in the valves, or only the elastic fibres. In the last case the infantilism is of the same character as the defective development of the elastic fibres in the lungs and bronchi and perhaps also in the oesophagus and intestine, where it gives rise to spontaneous dilatation and diverticula respectively.

Several interesting papers have recently appeared dealing with the incidence and diagnosis of cardiac disease among recruits. All the writers are agreed as to the rarity of organic disease as compared with the frequency of neuro-circulatory asthenia or cardio-vascular disorder, which, according to Fahr, Carter, Cosgrove, and Edgar, is the most important disease in the United States Army and occurs in at least 0·5 per cent. of all the drafted men. In examination of 10,000 men at the Syracuse Recruit Camp Rothschild found this condition in 616, or 6·16 per cent. The diagnosis of mitral regurgitation, which this writer regards as the most difficult of all valvular diseases to recognize, was made in 33 instances, or in 0·33 per cent. Systolic murmurs were recorded in 870 cases, or 8·7 per cent., but only 33, or 3·8 per cent., of the 870 cases were labelled mitral regurgitation. Cardiac hypertrophy, a systolic apical murmur, and a definite history of one or more attacks of acute articular rheumatism were the criteria observed, the coexistence of the first and second or second and third being required before the diagnosis of mitral regurgitation was made. In a subsequent paper on the diagnosis of mitral stenosis Rothschild states that in the examination of 25,813 soldiers he found mitral stenosis in 0·56 per cent. A definite history of rheumatism was obtained in 60 out of 168 cases, or in 35·1 per cent.; in the remainder there were histories of sore throats, scarlet fever, pneumonia, small-pox, and other infections. The presence or absence of a thrill was of little value because of the danger of the confusion of the presystolic thrill of mitral stenosis with the systolic thrill so frequently found in the overacting heart. This condition, which has very frequently been confused with mitral stenosis, is distinguished from it by the fact that in early mitral stenosis there are none of the peripheral manifestations of neuro-circulatory asthenia, such as cold, cyanotic extremities, sweating, &c. In the functional cases there is a snappy first sound with or without a systolic murmur and an accentuated pulmonary second sound. It is important to auscultate during slow heart action which can be obtained by pressure on the eyeballs. In functional cases the murmur disappears during ocular pressure, while in mitral stenosis the murmur remains unchanged or is accentuated.

In the examination of 55,000 recruits Fahr, Carter, Cosgrove, and Edgar found that the incidence of aortic insufficiency in Texas and Oklahoma was about 0·1 per cent. between the ages of 21 and 31. Uncomplicated mitral insufficiency of endocarditic origin was comparatively rare, its frequency being probably not much greater than 0·1 per cent. for men between 21 and 31 years of age. Accidental systolic murmurs at the apex were very common, being found in about 3 per cent., and were practically of no significance unless accompanied by signs of hypertrophy and increased pulmonary pressure. The incidence of mitral stenosis was about 0·02 per cent.; of idiopathic hypertrophy about 0·01 per cent.; of hypertension 0·02 per cent.; and of hyperthyroidism 0·015 per cent.

In the Third Report compiled by Russell Wells on the Collective Investigation of 10,000 Recruits at the National Hospital for Diseases of the Heart the aetiology of aortic regurgitation which was found in 307 cases is discussed. The results of the investigation led to the conclusion that the two important causes of aortic regurgitation were rheumatic fever and strain. No definite correlation in these cases could be found between syphilis, tonsillitis, scarlet fever, diphtheria, pneumonia, gonorrhoea, or growing pains, and the evidence was against influenza. With regard to chorea there was a suggestion that in some of the results it might be a cause, but the number of cases was so small, and the proportion of them with a history of rheumatic fever as well was so large, that caution had to be exercised in drawing deductions. With regard to a history of rheumatism there was some evidence for supposing that in a certain proportion of the cases, but not all, an affection of the same nature as rheumatic fever was referred to.

In a consecutive series of 100 soldiers sent to a heart section complaining of pain in the left side of the chest, Parkinson found 28 who also complained of pain in the left scapular region. This symptom was present in cases of valvular disease of the heart, myocardial disease, arteriosclerosis, and chronic nephritis where the heart had become overburdened, functional heart disorders with or without nervous symptoms, and general ill-health where the symptoms suggested cardiac disease. Ten of the 28 cases showed hyperalgesia on the posterior surface of the chest, involving in every case the lower part of the scapula though sometimes extending far beyond it. If the hyperalgesia persisted and recurred frequently, it indicated a new and troublesome phase of the disease. Parkinson attributes the pain to the fact that the sixth thoracic spinal segment alone or in combination with the fifth supplies the submammary and infrascapular regions where pain is commonly felt in heart affections. The hyperalgesia may be limited to the distribution of the sixth or fifth and sixth segments, but is often much more extensive.

Laubry and Esmein (2) distinguish three groups of disordered action of the heart: (1) Cases with moderate cardiac instability which present an excessive acceleration of the cardiac rhythm in the vertical position or on effort, but which rapidly subsides at rest and in the recumbent position. (2) Cases with pronounced instability in which a return to normal occurs only after a prolonged rest. (3) Cases with excessive instability or continuous tachycardia. The most seductive theory to account for the disordered action of the heart is a disturbance of the glands of internal secretion, especially an excessive secretion of the thyroid gland. As Kocher and his pupils had shown that the blood in Graves's disease is characterized by a considerable increase in the number of the mononuclears, Laubry and Esmein examined the blood in 30 cases of disordered action of the heart, and in 22 found a mononucleosis which in 8 was pronounced and in 14 slight. In 5 cases the leucocyte count was absolutely normal and in 3 there was a predominance of the polymorphonuclears.

The following circumstances militated against a causal relationship between disordered action of the heart and mononucleosis. (1) There was no relation between the leucocyte formula and the degree of the cardiac instability. A patient with continuous tachycardia might have a normal leucocyte count, while another in whom the rhythm was normal at rest might have his formula affected. (2) There was no definite relation between the duration of the cardiac instability and the degree of the mononucleosis. In a patient who had had cardiac symptoms for several years the leucocyte formula was hardly affected, while the contrary was found in recent cases. (3) The leucocyte reaction did not appear to possess the constancy necessary for a fundamental symptom, as within a few months, or even weeks, the percentage of the polymorphonuclears might range from 45 to 70 and of the mononuclears from 40 to 26 without a corresponding improvement in the physical signs. (4) Other factors than hyperthyroidism might account for the mononucleosis, such as convalescence from acute infectious diseases, latent tuberculosis, adenoids, and hereditary syphilis.

Laubry and Esmein (3) have found that a number of their patients with disordered action of the heart presented certain peculiarities in their temperature, and especially a striking difference between their morning and evening record. Much the most frequent type of chart was the hyperthermic in which the morning temperature was normal, and the evening temperature was 100·4° without anything to account for it. The evening rise might occur at regular or irregular intervals. In the hypothermic type the morning temperature was usually about 96·8° and the evening temperature 98·6° with a rise to 100·4° at more or less long intervals. It was impossible to find any trace of a latent infection in these cases, especially tuberculosis.

Two new diagnostic methods for patients with cardiac disease are described by Benjamin and Brooks.

1. In cases of tachycardia the patient is told to drop his head and bend forward at an angle of 45 degrees, whereupon the rapid heart will retard to a remarkable degree very quickly, sometimes to half the original rate if the case is one of simple tachycardia. The other type is not affected at all. The rate in the bending position corresponds fairly closely to the rate in the recumbent posture. It requires less time to resume a nearly normal rate in the former than the latter procedure and is thus a quicker method.

2. The writers have adopted the use of amyl nitrite inhalations as recommended by Morison (*Brit. M. J.*, 1918, i. 452) in the diagnosis of presystolic murmurs. In 10 out of 48 cases examined, the doubtful nature of the presystolic sound was intensified to such a degree as to admit of a positive diagnosis of mitral stenosis. In the remaining cases, the suggestive presystolic sounds were eliminated.

A type of acrocyanosis in soldiers accompanied by a rise in the arterial tension is described by Cordier. The condition occurs in men over 35 years of age and consists in attacks of cyanosis of the hands or feet at intervals of one to several days, sometimes accompanied by oedema and cramp. It is only after the symptoms have recurred several times that slight trophic changes develop, but they are by no means comparable to Raynaud's disease. The cyanosis is always associated with a change in the arterial tension, the general blood-pressure rising to 15–20 mm. above the normal. There is also a change in the local tension, patients with unilateral acrocyanosis showing a difference of 10–20 mm. Hg between the two radials. In most of the cases the patients had been subjected for many months to the toxic influences of life at the front, especially alcoholism and an almost exclusively meat diet. Cordier regards the condition as a prodrome of definitive changes in the blood-pressure. Of 25 cases under his observation, 7 were already cardio-renal subjects, 3 had a large heart and intermittent albuminuria, and of 10 other cases 4 developed albuminuria with hypertension.

Vaquez points out that an accidental fall of blood-pressure in the course of permanent hypertension may be brought about by several causes. Some infectious diseases, such as enteric fever, pneumonia, and especially influenza, may lower the blood-pressure to such an extent that the hypertension disappears altogether. In a patient with pneumonia the blood-pressure fell from 240 to 160 mm. Hg, and did not rise again until convalescence, though it did not regain its former level. In the recent epidemic of influenza many patients showed a fall of 70–80 mm. Hg which persisted even after recovery. Cardiac failure has the same effect. After an attack of acute dilatation it is not uncommon for the blood-pressure to fall 50–60 mm. and to remain low for a very long period, especially if the dilatation has been followed by functional insufficiency of the auriculo-ventricular valves. Chronic cardiac insufficiency has the same effect, and the existence of a blood-pressure of 160–170 mm. Hg in a case of complete arrhythmia does not justify the conclusion that the reading has never been higher. Coma has also a remarkably depressing influence on the arterial tension. In one case the pressure fell from 270 to 160 mm. in the course of a fulminating attack of cerebral haemorrhage. These circumstances to some extent explain the pathogenesis of arterial hypertension, although most writers regard it as due to renal lesions which are so frequent in hypertension. Vaquez, like Traube and Stenhouse Kirkes, holds that the hypertension is primary, being independent, in its onset at least, of any organic lesion, and is due to a functional disturbance of the organs regulating the blood-pressure.

In an article on cardiac hypertrophy in pernicious anaemia Cabot and Richardson state that out of 19 cases of pernicious anaemia that came to autopsy at the Massachusetts general hospital between 1908 and 1919, 18 showed definite cardiac hypertrophy or dilatation of the heart. In three cases causes for the hypertrophy were found in the arteries, kidneys, or valvular disease of the heart, but in the remaining 15 none of the usual causes were present.

The symptoms and treatment of syphilis of the aorta are discussed by Hubert of the Munich Medical Clinique in a paper based on 220 cases which he classifies as follows: uncomplicated aortitis 118 cases, aortitis with involvement of the coronary arteries 15 cases, aortic incompetence 54 cases, aortic aneurysm 33 cases. In 186 cases in which the Wassermann reaction was performed, a positive result was obtained in 155, or 85 per cent. Fifty-four cases or 25 per cent. had tabes, which in the majority of cases was mild or even rudimentary. In only six was it advanced. In the majority of cases syphilis of the aorta was the only sign of tertiary syphilis. Enlargement of the spleen was found in 26 per cent.

Aortic syphilis is a late manifestation of the disease. In 60 cases in which the date of infection could be determined, the average interval between infection and the onset of aortitis was 23½ years. Almost all the statistics in the literature agree with this figure, the average interval being reckoned by Stadler as 21·5 years, by Weintraut as 23 years, by Korczynski as 15–20 years, by Lippmann as 15–20 years, by Deneke as 10–15 years, and by Donath as 18 years. A shorter interval is given by Reinhold—6–8 years—and by Gruber—8–14 years. In two cases seen by Hubert the interval was 4 years, and in another two 5–6 years. In the overwhelming majority, however, the aortic disease set in 15–25 years after infection.

According to Hubert syphilis of the aorta constitutes 70 per cent. of all cases of visceral syphilis. The percentage of syphilis of the aorta in relation to syphilis generally is naturally lower than when only cases with definite changes in the organs are taken into account. Thus among 1,485 cases of syphilis Hubert found syphilis of the aorta in 216 cases or 14·6 per cent.; and among 1,380 cardiac cases in hospital in 216 cases or 15·5 per cent. The condition is decidedly commoner among men than in women, two-thirds of Hubert's cases being men. Probably the aorta in men is more predisposed owing to hard work, with which over-indulgence in alcohol and tobacco is associated.

The symptoms depend on the situation, extent, and degree of the changes. In 35 per cent. of the cases with well-marked specific aortitis the patients had no subjective disturbances, and even in a few instances of aortic incompetence and aneurysm the patient did not complain of anything. In the majority of cases, however, subjective disturbances were always present and were pathognomonic. The patients complained of a distressing feeling of pressure behind the upper part of the sternum, and a sense of constriction and oppression in the left side of the chest. In many cases there was a severe cutting or burning pain. About one-third of Hubert's patients suffered from shortness of breath on exertion. Some had indefinite gastric symptoms, nausea and eructation. 70 per cent. of the cases showed a characteristic colour of the skin, which was pale grey, and often had a yellowish or brownish tint, resembling that of cancer patients. There was but little to be discovered on percussion. Dullness over the aorta, which is very frequent in aortic incompetence, could be found with certainty in only 9 out of 133 cases. In half the cases the heart was a little enlarged to the left. Considerable enlargement was found only in patients with chronic renal changes and in cases of very severe cardiac insufficiency. Much more valuable information was furnished by auscultation. Accentuation of the second aortic sound was present in almost all cases, and was the earliest symptom of aortic disease. A systolic murmur over the aorta was heard in 75 per cent. In contrast with the murmur of aortic stenosis the second sound is heard distinctly in aortic syphilis, and in most cases is even accentuated. A systolic murmur over the aorta with an accentuated second sound without a rise of blood-pressure must be regarded as characteristic of a local disease of the aorta caused by syphilis or arteriosclerosis, if juvenile thickening of the arterial wall, psychical excitement, and Graves's disease can be excluded.

The pulse in Hubert's cases did not show any deviation from the normal. In 74·5 per cent. of the cases without renal complications the blood-pressure was barely or not at all raised. In only a quarter of the cases was there a moderate but distinct rise of the maximum pressure.

X-ray examination is of considerable diagnostic value in aortic disease, as it not infrequently shows a dilatation of the aorta before this can be detected clinically.

The distinction of syphilitic aortitis from arteriosclerosis of the aorta is a most difficult problem, and cannot be absolutely certain even when all the chief symptoms of syphilitic aortitis are fully developed. The three physical signs, accentuated or ringing second aortic sound, systolic murmur over the aorta, and aortic dilatation, have no diagnostic significance, although it is true that accentuation of the second aortic sound and a systolic murmur are more frequent in syphilis than in arteriosclerosis. A positive Wassermann reaction, though important, is not conclusive, as it merely indicates syphilitic infection and not the specific character of the aortic disease. The patient's general condition is more distinctive. The striking pallor and loss of nutrition are foreign to arteriosclerosis, especially at the onset of the affection.

The determination of the stage of infection is also important. A history of syphilis contracted 15–25 years before, the presence of the characteristic symptoms without obvious cause, a positive Wassermann reaction, and the objective changes, make the diagnosis of aortic syphilis probable and justify specific treatment. The principal complications of syphilis of the aorta are involvement of the coronary arteries, aortic incompetence, and aneurysm. Involvement of the coronary arteries was found in 30 of Hubert's cases or in 14 per cent. The diagnosis was not always made during life, as stenosis of the coronary arteries does not invariably cause clinical symptoms, though in most cases it gives rise to angina pectoris.

Aortic incompetence was present in 31·5 per cent. of Hubert's cases. It may be caused directly by disease of the valves or indirectly by stretching of the aortic lumen. The question often arises as to whether an aortic incompetence is syphilitic or endocardial. The frequency of syphilitic aortic incompetence is shown by the fact that in the Munich

Medical Clinique 67 per cent. of all the cases of aortic incompetence were syphilitic, 17 per cent. were endocardial, and 5 per cent. arteriosclerotic.

Aneurysm was found in 33 cases or 16 per cent. At first it causes no symptoms and is only discovered by X-ray examination. In advanced cases the characteristic symptoms appear.

The prognosis of syphilitic disease of the aorta depends on the situation of the lesions and the occurrence of complications. The development of aortic incompetence appears to be particularly unfavourable. Forty-eight of Hubert's cases died, death occurring on the average from 12 to 15 months after the first appearance of the disease. The patients succumbed most frequently to intercurrent diseases such as broncho-pneumonia, pyelitis in the course of tabes, or kidney complications. Cardiac insufficiency came next, aortic incompetence being by far the commonest cause of death. Angina pectoris on the other hand was less important, as in only 16 per cent. of the fatal cases was it the direct cause of death, while aneurysmal rupture occurred in barely a third.

The success of treatment of aortic syphilis depends upon the energy and persistence with which it is carried out. Hubert's patients were given 4–4½ gm. of neosalvarsan in doses rising from 0·15 to 0·45 gm. A single course may sometimes cure all the subjective symptoms, but is not sufficient to heal the morbid process, and the treatment should therefore be repeated at intervals of three to four months. The Wassermann reaction does not play an important part in the treatment, as in a very large proportion of the cases a negative result could not be obtained in spite of a frequent repetition of the doses recommended above.

Brown records five cases of syphilitic aortitis which illustrate the following points: (1) The frequency with which specific aortitis is confused with pulmonary disease, such as tuberculosis, pneumonia, or pleurisy. (2) That specific aortitis is not always a late manifestation of syphilis, as one case occurred probably 6–8 months after infection. (3) That practically all physical signs may be absent and the diagnosis will rest on substernal distress, a positive Wassermann reaction, and the therapeutic test. (4) That aortitis should be diagnosed before the more gross pathological changes have taken place, as when that stage is reached treatment is usually ineffective.

In a note entitled 'Respiratory Effort and Paroxysmal Tachycardia', Fiessinger quotes several cases to prove that any respiratory effort, whether inspiratory or expiratory, sufficiently sustained is capable of stopping an attack of paroxysmal tachycardia, provided that the patient knows how to take a deep breath, and has enough strength to do so. After infectious diseases, such as influenza, especially when antipyretics have been used, the myocardium may be affected, and the patient is too weak to make any respiratory effort. It may be noted that in several of Fiessinger's cases a respiratory effort stopped the attack after pressure on the eyeballs had proved ineffectual.

In an article on the prolonged use of cardiac tonics, Galli relates the case of a man aged 50 with mitral disease who for two years took 20 minims of tincture of strophanthus daily without any harm or any apparent functional disturbance of the heart apart from slight attacks of cardiospasm. Galli remarks that this case, as well as the fact that the great majority of the population made a constant use of another tonic (there being as much as 10–15 cgm. of caffeine in a cup of coffee), should encourage us to be more bold in the use of cardiac tonics.

The therapeutical value of the oculo-cardiac reflex is illustrated by Voisin and Benhamou. While investigating the reflex in two patients with paroxysmal tachycardia without cardiac lesions one of the writers observed an immediate and persistent stoppage of the attack. In another case of tachycardia without organic lesions and accompanied by a normal arterial tension, pressure on the eyeballs reduced the rate from 120 to 72 for several minutes. Maintenance of the pressure on the right eye caused a longer duration of the slowing, the patient felt more comfortable, and the period of cardiac repose lasted two to three hours. The process was repeated daily for a week, and the pulse-rate then remained permanently between 70 and 80. The writers have also found that hysterical symptoms, such as convulsions and tremors, can be stopped by examination of the reflex.

In the course of the last twelve years von der Velden has employed intracardial injections of circulatory stimulants, such as strophanthin, digifolin, digipuratum, camphor oil, caffeine, or suprarenal preparations, in cases in which the drug could not be introduced into the circulation in any other way, and when even injection into the jugular vein failed. The injection was made in the fourth or fifth intercostal space about two fingers' breadths from the left border of the sternum, so as to avoid the internal mammary artery, and usually the right ventricle or in a few cases the right auricle was reached. The injection site naturally varied with the conformation of the thorax, the position of the diaphragm, the form and size of the heart, and other circumstances. A Record syringe was used, twice to three times the ordinary length, but of the ordinary diameter. It was sufficient to pass it into the myocardium, and in no case was the actual cavity of the ventricle reached, the stimulus of the puncture of the epicardium or heart muscle being doubtless sufficient to cause an immediate contraction of the heart. In about one-third of the cases the success of the injection was surprising. The pulse, which up till then had been no longer or only barely perceptible, became strong; the heart sounds, which had previously been almost inaudible, became vigorous, and consciousness returned. In two-thirds of the cases no effect was produced. The time of the injection, the character of the drug, and especially the cause of the cardiac failure were of great importance. No success was obtained in heart-failure due to gas-poisoning or infectious diseases (enteric fever, influenza, septicaemia), and good results only occurred in the cases of ' heart disease ', i. e. various forms of myocardial disease with or without valvular affection. It was never possible to keep the circulation going for more than eight hours. All the cases died, and a second intracardial injection which was made in four cases had no effect.

Hesse has employed intracardial injection of strophanthin ($\frac{1}{2}$ mg. in 15–20 c.c. of normal saline) in perforative peritonitis, mitral stenosis and incompetence with loss of compensation, cerebro-spinal fever, scarlatina, diphtheria, chronic interstitial nephritis, pneumonia, pulmonary tuberculosis, enteric fever and cerebral softening. In four cases the heart sounds became strong and the pulse perceptible, but the improvement lasted at most only 20 minutes and death then took place. In other cases either the heart sounds became audible without the pulse becoming perceptible, or no reaction whatever took place. Hesse considers that the treatment is most likely to be successful in cases of sudden cardiac paralysis resulting from surgical anaesthesia, shock, or intoxication, or in cases of chronic but untreated weakness of the cardiac muscle which first come under treatment in the stage of exhaustion.

Shortly before the publication of von der Velden's paper Zuntz was able to save the life of a patient by intracardial injection of 1 c.c. of the ordinary solution of adrenalin after all other methods had failed. The patient was a woman aged 52, with normal heart and lungs, though in a very poor general condition, who stopped breathing during ileocaecostomy for a malignant growth. The wound healed by first intention, and a fortnight after the operation, when Zuntz's paper was published, the patient was doing well. This appears to be the only case on record in which intracardial injection has been successful after all evidence of life has become extinct.

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J. D. R.

## ALIMENTARY DISEASES

**Syphilis of the parotid.** The salivary glands are rarely affected in syphilis. Fourteen cases were collected by Koschel in 1898 and 20 by Küttner in 1908. The great majority have occurred in women, and always in association with other syphilitic lesions. Tertiary syphilis of the salivary glands, like that of other organs, may assume the form of a gumma or a diffuse sclerosis. An instance of the latter type is recorded by Guibaud in a woman aged 49, who had probably been infected by her husband 27 years previously. The patient presented a hard painless swelling of the left parotid with some interference with the movements of the jaw, but no trismus nor disturbance of deglutition, speech, or salivation. The Wassermann reaction was positive. The swelling disappeared after five intravenous injections of novarsenobenzol.

More recently Lemierre has reported a case of bilateral parotitis in a soldier, aged 22, complicated by left facial paralysis. There was no family or personal history of syphilis, but complete recovery followed administration of potassium iodide.

**Syphilis of the stomach.** One of the localizations of syphilis in which an accurate diagnosis is most important, for the pseudo-cancerous form, which is much more frequent than that resembling ordinary chronic gastritis or gastric ulcer, may lead to an unnecessary operation when its true nature is not recognized. It is not improbable that a certain number of successful operations on supposed cases of gastric carcinoma are due to errors of this kind. Azémar and Lacapère report three cases in patients who all presented the triad of symptoms, pain, tumour, and cachexia, suggesting cancer of the stomach. The other symptoms, however, were very vague. There was no haematemesis and hardly any vomiting. In the two cases in which it was performed, the Wassermann reaction was strongly positive, and in the other case active tertiary lesions of the skin were also present.

The form of tertiary syphilis, of which these cases are examples, consequently belonged to the active period of the disease and consisted of a gummatous infiltration of the stomach wall. All the cases were cured by antispecific treatment, the only difference being that recovery was rapid in the two cases treated by arsenobenzol, and slow in the case treated by mercury only.

Another case of syphilis of the stomach is recorded by Galliard and Mendelssohn in a man aged 55, who had had a chancre followed by mucous tubercles at the age of 22. About 30 years later he began to suffer from dyspepsia, gastric crises, and profuse diarrhoea. There was no haematemesis, melaena, or any tumour. The reflexes were normal, and there were no ocular or other manifestations of tabes. X-ray examination showed a movable stomach free from adhesions, but with a sort of constriction which gave it a bilocular appearance, and might have been attributed to scar tissue if it had not disappeared completely in a few weeks' time, together with the dyspepsia, gastric crises, and diarrhoea, under the influence of mercurial treatment.

**Traumatic gastric ulcer.** Gross records the case of a previously healthy man, aged 47, who, within a few months after a blow from a pole in the epigastrium, developed symptoms of gastric ulcer, the diagnosis of which was confirmed by a skiagram and also by haematemesis. Several similar cases are on record (vide *Medical Supplement*, 1918, **1**, 347–8). Almost all writers are agreed that nutritional changes in the gastric mucous membrane are a necessary condition for ulcer, and it is obvious that violence exerted on the stomach from without will produce such an effect. It is not even necessary that the trauma should affect the actual gastric region, as clinical cases and experiments on animals have shown that injury of other abdominal organs, such as the mesentery, may lead to the formation of gastric ulcer.

**Aerophagia.** The minor signs of aerophagia, according to Leven, are a red, moist, and shiny tongue, due to profuse salivation, which is also shown by dribbling on the pillow during the night. The sialorrhoea causes frequent movements of deglutition which give rise to irritation of the laryngeal region and prevents the patient wearing a close-fitting collar or bodice. The patient who swallows an excess of air is unable to lie on the left side without suffering at once from difficulty in breathing and palpitation. He can only sleep on his right side, and if by chance he turns over on the left, he is at once woken up by a feeling of distress.

In an article on the occurrence of **anacidity in soldiers** on active service, Böhme alludes to the papers on this subject by Cramer (vide *Medical Supplement*, 1918, **1**, 31 *a*), Heinsheimer (*ibid.*, 181 *a*), Albu, Grote, and Curschmann (*ibid.*, 254 *a*), and records his observations on 434 gastric cases, one half of which occurred in the winter and spring of 1917 on the Eastern front and the other half a year later on the Western front. Only five of the 234 cases seen on the Eastern front showed gross anatomical changes, viz. four of gastric ulcer and one of carcinoma. The majority of the cases were examples of dyspepsia which ran a favourable course, usually without much disturbance of secretion. There was a considerable proportion of cases of nervous dyspepsia with approximately normal acidity. Examples of pronounced hyperacidity were comparatively rare. Only 22 or 9·3 per cent. showed a total acidity of over 60. A third of the cases had a total acidity below 20 per cent. with absence or only traces of free hydrochloric acid. In the great majority of anacid cases the acidity was under 10. A relatively small total acidity (21–40) was found in 31·6 per cent., while normal values of 41–60 constituted a percentage of only 25·6. Values above 60 were rare. Cases of an- and sub-acidity together amounted to 64·9 per cent. of the total. In a small number of cases the gastric secretion improved while the patients were under observation in hospital, and the acidity approached the normal. In the great majority, however, the anacidity persisted during the period of observation. Infectious diseases, such as enteric and dysentery, which might have caused the anacidity, had occurred in only a few instances. Many patients admitted that they had suffered from a weak stomach for years, but added that it had got much worse during the war. Bad or defective teeth were frequently found in the anacid cases. Very similar observations were made on the Western front, the only difference being that on the Western front the cases occurred among younger men whose state of nutrition had not been much impaired. The anacidity is attributed by Böhme to the monotonous character of the soldiers' diet.

In 340 cases of dyspepsia, Ramond found an anachlorhydria, i.e. an absence of free and combined hydrochloric acid, in 11 per cent., and apepsia, i.e. an absence of hydrochloric acid and pepsin, in only 0·5 per cent. The chief causes of anachlorhydria are (1) infections, especially influenza, enteric, and diphtheria. (2) Intoxications, (*a*) acute, of which carbon monoxide and gas-poisoning are the commonest, (*b*) chronic, e. g. alcohol, lead, drugs, and tobacco. (3) Nervous causes, including commotion, melancholia, neurasthenia, and tabes. It is only exceptionally that anachlorhydria is transient. As a rule it is permanent or at least of very long duration. If the total acidity exceeds 1 gm., the prognosis is relatively favourable, and the reappearance of hydrochloric acid is possible, except in some cases of pyloric cancer accompanied by a larger quantity of organic acids due to fermentation. But if the total acidity is low, the anachlorhydria persists for an indefinite period.

**Carcinoma of the stomach.** In an article entitled 'Has gastric carcinoma increased during the war?' Kloiber, who is attached to the Frankfort Surgical Clinique, states that during the pre-war years 1911–14 95 cases of gastric carcinoma were operated on at the Clinique as compared with 69 cases in the years 1915–18. On the other hand, the number of callous gastric ulcers has considerably increased since the outbreak of war, 14 having come under treatment in 1911–14 and 57 in 1915–18. On adding together the cases of callous ulcer and gastric cancer, an almost equal number of gastric cases is obtained in the two periods. Kloiber concludes that the frequency of gastric cancer has not been affected by the war and war diet.

Gouget quotes cases from the literature and one of his own to show that carcinoma of the stomach may be masked by the occurrence of a diffuse and even generalized dropsy and not give rise to any appreciable gastric symptoms until the end. The anaemia may be only moderate, and the degree of emaciation will be difficult to determine owing to the oedema, which may last a year or more, with remissions, or even completely disappear so as to enable the patient to resume his occupation. Neither examination of the blood nor analysis of the gastric juice can supply sufficiently definite information, but the diagnosis will be established by the repeated discovery of occult haemorrhage in the stools by Weber's method.

A case of pyloric hypertrophy in pernicious anaemia is recorded by Kleemann in a man aged 39, in whom the diagnosis during life was extreme anaemia and suspected carcinoma of the stomach. The necropsy showed an absence of ulceration or new growth and merely a simple hypertrophy of the pyloric musculature, probably due to a spasm of the pylorus which was found on X-ray examination. This case is not an isolated one, as Nägeli in 1912 showed that spasm of the pylorus in pernicious anaemia may often resemble carcinoma. Probably in most of these cases the spasm of the pylorus is only functional, but occasionally it may lead to pyloric hypertrophy.

The nature of the **digestive disturbances following gastro-enterostomy** was investigated by Oehnell in 30 cases in Jacobaeus's medical clinique at

Stockholm. He found that a more or less diminished gastric digestion was the rule, remains of connective tissue being found with fair regularity in the faeces. The diarrhoea occurring after the operation may therefore be regarded as belonging to the type described by Adolf Schmidt as gastrogenous dyspepsia. A diminished utilization of fat was also noted. On the other hand a lowered carbohydrate tolerance was exceptional, and in only one case were there changes in the stools indicating involvement of the pancreas.

The rarity of primary **carcinoma of the duodenum,** of which Head reports an example in a man aged 74, is shown by the fact that Perry and Shaw found only 4 cases in 18,000 autopsies on examination of the Guy's Hospital Reports, and only 18 cases were found out of 19,500 autopsies at the London Hospital. The clinical picture depends upon the situation of the growth in the duodenum. Carcinoma above the biliary papilla presents the symptoms of pyloric stenosis with or without haematemesis, and a palpable mass is usually present. Carcinoma in the second part of the duodenum is usually ushered in by a slowly developing icterus without pain or vomiting. The jaundice persists, vomiting develops, the liver becomes enlarged, the gall-bladder may be distended and palpable, and the patient dies from inanition. A palpable mass may or may not be present. In cancer of the third part of the duodenum, of which Head's case was an example, the first symptoms consist of flatulence and discomfort after meals, burning acid eructations, loss of appetite, and gradual emaciation. After a few months vomiting appears and persists till the end. There is marked cachexia and rapid loss of flesh. The bowels are obstinately constipated. The vomit always contains bile, which gives it a light green colour. From time to time attacks of intestinal obstruction occur, attended by incessant vomiting and obstinate constipation. No tumour as a rule can be felt unless the retro-peritoneal glands are involved.

Three cases of the **large war abdomen** described by Pisani and Ceconi in Italy (vide *Medical Supplement,* 1918, **1**, 255 *b*), and by Dénechau in France (*ibid.,* 1919, **2**, 177 *b*), were reported by Piazza at the Palermo Medico-Chirurgical Association. In each case the symptoms had developed suddenly without any special reason and without any previous psychical trauma. None of the patients had even been in the war zone. In all three cases the abdomen was projected forwards with a well-marked lumbar lordosis. Examination of the cases showed that there was no meteorism from abnormal development or excessive elimination of gas, but an entirely different state of affairs. The abdomen was of a hard elastic consistency, its condition being due, as shown by X-rays, to tonic spasm of the diaphragm. Good results were obtained by bromides in one case, but in the other two cases no effect was produced by this drug.

According to Carles the **chronic enteritis** met with in soldiers may be due to various causes. (1) It may be the result of chronic amoebiasis, which is easily recognized by the presence of amoebae or cysts in the stools and readily cured by the double iodide of bismuth and emetine. (2) It may be due to intestinal infection by various parasites, such as lamblia, cercomonas, tetramitus, trichomonas, or less frequently *Ankylostoma duodenale,* trichocephalus, ascaris, &c., and according to the nature of the parasite can be cured more or less rapidly by the appropriate remedy. (3) In rare instances it is a remote sequel of paratyphoid fever or bacillary dysentery. The recto-colic ulcers which result can often only be cured by local treatment controlled by proctoscopy. Injections of anti-dysenteric serum or paratyphoid vaccine may also be required. (4) It may be caused by functional digestive disturbance, the nature and degree of which are established by test meals. It is then easily corrected by supplying the requisite secretion, such as pepsin, papain, hydrochloric acid, pancreatin, or enterokinase. (5) It may be the result of an exaggeration of normal intestinal fermentation which can be cured by a suitable regimen and by growing antagonistic micro-organisms in the intestine. (6) It is sometimes caused by irritation of the abdominal sympathetic. (7) An association of several of the above causes is not rare. Amoebiasis is often accompanied with lamblia infection, secretory insufficiency or intestinal neurosis may easily complicate amoebiasis or fermentative enteritis, and a combined treatment is then required.

During the last two years Loeper (1) has examined the **nerve supply of the intestine** and its glands in 36 cases including dysentery, enteric fever, all forms of colitis, and duodenal ulceration, specific and tuberculous enteritis. The lesions discovered were very numerous and could be classified in three groups: (1) degenerative; (2) inflammatory; (3) fibrotic. The degenerative lesions were characteristic of acute colitis and enteritis and were chiefly found in enteric, choleriform enteritis, and cholera. They were most marked at the site of Peyer's patches, but they might extend throughout the ileum and small intestine. The nerve fibres were dissociated and broken up, only a few droplets of fat being seen after the action of osmic acid. The cells were homogeneous in appearance, and sometimes oedematous, their contour was obliterated, and the nucleus was displaced towards the surface of the protoplasm. The inflammatory lesions might also be found in enteric, but were rather the characteristic of subacute or more penetrating processes, such as duodenal ulcer, ulcerative colitis, dysentery, and tuberculosis. The fibrotic lesions were found chiefly in chronic dysentery and tuberculosis. The presence of these nervous lesions explains the persistence of pain and disturbance of intestinal function after the acute symptoms have subsided.

In a subsequent paper Loeper (2) shows that the paroxysms of abdominal pain in cancer of the intestine are due to the extension of the new growth to the mesenteric nerves by which it is conveyed to the solar plexus.

In opposition to the opinion held by some writers, such as Gelinsky (vide *Medical Supplement*, 1918, **1**, 255 *a*), Selberg maintains that **appendicitis** has not diminished either in frequency or severity, but, on the contrary, that war diet has favoured the outbreak of attacks of appendicitis. Unlike those who hold that appendicitis is due to constipation, Selberg has found that all severe attacks both in peace and war time have followed diarrhoea. Acute intestinal catarrh occurring on active service exercised a specially unfavourable action on chronic appendicitis, frequently converting a latent condition into very severe gangrene. Appendicitis was most frequent in the summer months owing to the increase in the number of infective intestinal diseases at that time.

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J. D. R.

## LETHARGIC ENCEPHALITIS

Several papers have recently appeared in the French medical press on the recrudescence of epidemic encephalitis in various parts of France and Belgium. In the outbreak in the spring of 1918 the disease was chiefly confined to Paris. Étienne of Nancy now records two cases which occurred in the east of France in January 1919, and Audibert one at the same time at Marseilles; the patient, however, had only left Fontainebleau a fortnight previously. Netter also alludes to recent cases which have occurred at Lyons and Brussels, and reports two cases communicated to him by Caryophillis of Athens, where they occurred in October 1918. Burger and Focquet report a case in a Belgian soldier who developed typical Jacksonian epilepsy on the day before death owing to extension of the disease to the grey matter of one hemisphere.

In Lereboullet and Hutinel's case which proved fatal after a week's illness, the post-mortem findings and inoculation into monkeys of the cerebro-spinal fluid removed during life and of a portion of the brain substance (*locus niger*) were almost completely negative, although the clinical symptoms were typical.

Claisse draws attention to the occurrence of incomplete forms which are characterized by disturbance of vision, and for which another term than lethargic encephalitis is applicable, as there is really no lethargy in such cases.

Milian, who regards lethargic encephalitis and the pulmonary form of influenza as identical in origin, records a fatal case in a woman who contracted influenza from her husband, whose attack was uncomplicated, and then developed broncho-pneumonia, in convalescence from which lethargic encephalitis occurred with bulbar symptoms, such as vomiting, tachycardia, and polypnoea without any signs in the lungs.

Grenet records a case of lethargic encephalitis which was characterized not only by the ordinary symptoms, such as somnolence, ptosis, squint, inequality of the pupils, paralysis of the frontalis and orbicularis oris, but also by cerebro-spinal lymphocytosis, trismus, and erythemato-pultaceous stomatitis. Mumps was excluded by the fact that though the patient was not isolated none of the seven other children in the family developed mumps. Similar cases have been seen by Netter.

A fatal case of lethargic encephalitis with abscess formation in the brain is reported by Parkes Weber in a man aged 48. *Post mortem* the abscess cavity occupied the anterior portion of the occipital and the posterior portion of the temporal lobe. On histological examination by Kinnier Wilson the nerve parenchyma did not show any sign of pathological change except in the areas round the abscess cavity where the white matter was somewhat swollen and in part destroyed. No sign of syphilitic endarteritis was present and there was nothing histologically to suggest a general invasion of the meninges.

In discussing the differential diagnosis of cases of lethargic encephalitis Parkes Weber states that the following conditions must be taken into consideration: (1) Psychoses characterized by lethargy, stupor, a state of *catalepsia cerea* or plastic catalepsy, &c. In several of the recent cases there has been a history of fright or mental shock, owing to air raids, &c. Possibly some of the cases classed as catalepsy were really sporadic examples of lethargic encephalitis. (2) Tuberculous meningitis both in adults and children. Various mistakes in diagnosis between the two conditions have often occurred during the recent epidemic. (3) Early syphilitic acute meningo-encephalitis and syphilitic disease of the cerebral blood-vessels, especially in young adults. In such cases the Wassermann reaction both with the blood and cerebro-spinal fluid will aid in the diagnosis. (4) Botulism due to *Bacillus botulinus.* The earlier cases of the recent epidemic were at first mistaken for botulism, but in no case was the specific bacillus discovered and no genuine cases of botulism were recorded at the time in England. (5) The encephalitis of Heine-Medin's disease. (6) Cerebral haemorrhage and cerebral thrombosis. Certain 'apoplectiform' cases of lethargic encephalitis may simulate cerebral haemorrhage or thrombosis, and *post mortem* large areas of softening and gross haemorrhages have occasionally been found. (7) Status epilepticus. (8) Uraemia. (9) Other kinds of encephalitis which may be connected with influenza, traumatism, mumps, &c.

Brasher, Caldwell, and Coombe record two cases of encephalitis lethargica which are of interest on account of their occurrence during the epidemic of influenza in October 1918, and also because the micro-organism found in the cerebro-spinal fluid appeared to be morphologically identical with that found in the blood, sputum, pleural fluid, and cerebrospinal fluid in cases of influenza, trench fever, and nephritis among British troops in France, as described by Rose Bradford, Bashford, and Wilson.

Alexander publishes six cases resembling encephalitis lethargica occurring during the influenza epidemic in January 1919, but differing from it in certain points, viz. (1) a more gradual onset; (2) the short duration with complete recovery in all the cases; (3) the ophthalmoplegia with ptosis which was constant in lethargic encephalitis was not a pronounced feature in this series.

Reinhart reports eight cases of lethargic encephalitis from the Kiel University clinique, all of which presented the symptoms described by von Economo. There was a more or less acute onset with symptoms resembling influenza, and then after an interval of several days the typical symptoms developed. Fever was usually present, but of no distinct type. The diagnosis was easy as a rule. The distinction from basal meningitis was made by the slight degree of the meningeal symptoms and the almost normal character of the cerebro-spinal fluid. The prognosis was grave. Four of the eight cases died, and in the patients who recovered the headache, vertigo, and apathy persisted for some time after the disappearance of paralysis.

Treatment consisted in the administration of urotropine and salicylic preparations and the performance of lumbar puncture every other day. After the acute symptoms had subsided injections of strychnine appeared to be beneficial.

The prevalence of the disease in the Kiel district was also discussed at the Kiel Medical Society on March 6, when Runge stated that in three out of 14 cases there had been an attack of influenza within the last six months, and in the others it could not be excluded. It could not, however, be decided whether the encephalitis was a sequel of influenza or an independent infectious disease. In an autopsy performed by Stern the lesions were very similar to those described by Economo, and diplostreptococci were found in the optic thalamus. Siemerling said that the disease was very liable to simulate general paralysis, meningitis, chorea, or even hysteria, and in a subsequent article records seven illustrative cases.

With the exception of a case described by Tacconi which occurred in February 1919 at Ancona in a woman aged 28, and ended in complete recovery after three weeks' illness, no case has been reported in Italy since 1890.

In his article on epidemic encephalitis Bassoe of Chicago draws attention to the fact that the only epidemic appearance of any similar disease in the past has been in connexion with epidemics of influenza. Following the pandemic of 1889–90 'nona' appeared in Northern Italy and then in Hungary, and spread westwards to Germany, France, and Italy. The present epidemic, like that of 'nona' in 1890, first appeared in Eastern Europe in 1917, when the name of lethargic encephalitis was given to the outbreak in Vienna. Thence it spread westwards, reaching France and England early in 1918, and the United States early in the autumn of the same year. The aetiological relationship of the disease to influenza rests upon the above-described coincidence of the two epidemics. Bassoe suggests that the encephalitis may itself be a cerebral form of influenza or that it may be caused by a separate virus, which in order to become active must have been in contact at one time or another with that of influenza.

It is not common in Bassoe's experience for the individual patient to have had a clinically distinct attack of influenza. Nearly all his patients, however, had been in a more or less run-down condition prior to the onset, and so may have been predisposed to a localization of the virus in the brain.

Ely of Des Moines, Iowa, records two cases in girls aged 6 and 18 years respectively. In neither case was there a history of influenza. In one case remarkable improvement followed removal of 20 c.c. of cerebro-spinal fluid. Ely draws attention to the similarity between the bodily lethargy in these cases and Parkinson's disease, and suggests that the minute haemorrhagic areas found in encephalitis lethargica may produce the same symptoms as the degenerated areas in the same structures in Parkinson's disease.

Pothier records 8 cases which occurred between October 1918 and February 1919, at Camp Lee, in Virginia. Four of the patients had had influenza from 6 weeks to 2 months previously. The commonest symptoms observed were vertigo, diplopia, headache, slight fever, and a slight spinal lymphocytosis. Only 1 case ended fatally.

Foster Kennedy reports four cases which he saw during the first three months of 1919 in New York, and states that in the course of a week seven more or less similar cases came under his observation. He regards the aetiology as conjectural, the diagnosis as simple, the contagiousness as unproved, and the treatment as symptomatic.

Tucker of Richmond, Virginia, reports 11 cases in which the incidence of influenza was so striking that he regards encephalitis lethargica 'as either a manifestation of a recrudescence or recurrence of influenza, or in certain cases the expression of influenza *per se*'. The characteristic somnolence is attributed by him to pressure and inflammation of the pituitary gland.

Gordon of Philadelphia, who reports three personal cases, holds that the question of the autonomy of encephalitis lethargica cannot be decided until further information has been obtained by extensive anatomical and bacteriological investigations.

Strauss, Hirshfeld, and Loewe carried out experiments on monkeys (*Macacus rhesus* and *M. cynomolgus*) at the Pathological Laboratory of Mount Sinai Hospital, New York, in an attempt to establish the aetiology of epidemic encephalitis. Their results were as follows: (1) Inoculation of emulsion of human brain produced lesions in the monkey characteristic of the lesions found in epidemic encephalitis. (2) The inoculation of the filtrate of the mucous membrane of the naso-pharynx of a patient not suffering from epidemic encephalitis produced no evidence of disease in the monkey. (3) The inoculation of the washings of the naso-pharynx in a case of epidemic encephalitis produced paralysis in the monkey accompanied by pleocytosis in the cerebro-spinal fluid. (4) A filtrable virus obtained from the mucous membrane of the naso-pharynx in a fatal case of epidemic encephalitis produced haemorrhagic encephalitis in the monkey. The virus was carried through a second generation.

Sachs, who is also attached to the Mount Sinai Hospital, lays stress on the fact that in many of the cases there was a distinct history of influenza preceding the onset of the lethargic disorder by several weeks, and remarks that if this sequence is not a mere coincidence, epidemic encephalitis bears a resemblance to post-diphtheritic palsies in its occurrence weeks after the initial affection. The prognosis is determined largely by the site of the lesion. All the fatal cases which Sachs has seen have been the bulbar forms, in which death has been due not to the general toxicity of the disease, but to the fact that the cardiac and respiratory centres have been the sites of predilection.

According to Cleland and Campbell of New South Wales, encephalitis lethargica appears to be distinct from the form of encephalomyelitis, which occurred as an epidemic in the late summer of 1917 and 1918, and was confined almost entirely to certain dry inland parts of New South Wales. Children mainly were affected, but adults were not spared. The disease was acute and severe, often abrupt in onset, and fatal in 70 per cent. of the cases. It was characterized by general signs of cerebro-spinal irritation, terminating in exhaustion, coma, and death in a few days, or in rapid recovery, usually complete, but in a few instances attended by flaccid paralysis or mental disorder. Microscopical examination of the nervous system in 16 cases showed a generalized acute encephalomyelitis. By intracerebral inoculation of an emulsion of portions of the nervous system of the human subject or animals dead of the disease the writers succeeded in transmitting the disease from man to monkey (*Macacus rhesus*); from monkey to man (in series); from sheep to sheep; back from sheep to monkey, and again through monkeys, and lastly from monkeys to horse and calf, the results always being confirmed by histological examination.

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J. D. R.

# ABSTRACTS

## SURGERY

**Austoni, A.** Contributo all' indirizzo di cura delle stenosi cicatriziali di alto grado dell' esophago. [**Treatment of cicatricial stricture of the oesophagus.**] *Policlin.*, 1919, **26**, 150.

The good results which Austoni obtained by the method of dilatation in four patients suffering from severe cicatricial stenosis of the oesophagus has led him to pass some criticisms on the opinions at present held as to the prognosis and treatment of such cases. The view is expressed by many Italian surgeons and in leading text-books on surgery that in cicatricial stenosis of the oesophagus treatment by means of dilatation can be used with any prospect of success only in comparatively recent cases, that is to say when the scar tissue is small in amount and of slight resistance. Austoni maintains, on the strength of his own experience and that of other surgeons, that, with perseverance, a bougie can almost always be passed even in the severest cases, and more or less rapid dilatation effected.

*Case I.*—The patient, a boy aged 4 years, swallowed a bobbin composed of two circular metal disks united by parallel bars 2½ cm. long. The bobbin became impacted at the junction of the cervical and thoracic portions of the oesophagus, and caused great dysphagia. Attempts to extract it and to force it into the stomach were unsuccessful. When first seen by Austoni, fifty days later, the patient was suffering not only from dysphagia but also from extreme dyspnoea and fever. With considerable difficulty the foreign body was extracted and in a few days the symptoms subsided. Although warned to return within a fortnight in order that the inevitable stenosis might receive treatment, the parents delayed for seven months, when the patient could swallow only small quantities of liquid and was in an emaciated condition. An attempt, persisted in for more than an hour, was made to pass a catgut urethral bougie; this was unsuccessful. After an interval of eight days a similar and prolonged attempt proved successful. Le Fort's urethral dilator was then introduced with the intention of effecting immediate dilatation; the resistance met with was, however, too great, and further operation was deferred for a week. At four subsequent sittings at intervals of eight days the dilator was passed with gradually increasing facility and the oesophagus dilated finally to a diameter of 20 mm. In the following nine months the dilator was used at intervals of 4–8 weeks. Four years later the patient was reported to be in good health and capable of taking all kinds of food without difficulty.

*Case II.*—Three years before, the patient, a boy aged 8 years, swallowed some 'essence of vinegar'. He was greatly emaciated, able to swallow only small quantities of liquid, slowly and with the aid of pressure on the sides of the neck, and an obstruction was located at a distance of 13 cm. from the front teeth. A urethral catgut bougie passed this obstruction without much difficulty and a second stricture was met with at a distance of 18 cm. After repeated attempts the catgut bougie was passed and Le Fort's dilator was then used as in the former case, and the upper constriction dilated to the extent of 9 mm.; the instrument could not, however, be introduced into the lower stricture. After allowing an interval of eight days, the upper stricture was further dilated to 12 mm., and it was now found that the dilator passed to a slight extent into the lower stricture. By a further delay of eight days its complete introduction was rendered possible, and the gradual dilatation of the stricture was commenced. Treatment at longer intervals was continued for four months until a maximum diameter of 20 mm. was reached. The patient was watched for three months subsequently, after which he failed to return and presumably had no recurrence of his trouble.

*Case III.*—Two years previously the patient, a woman aged 31, swallowed 50 c.c. of sulphuric acid. Within three weeks extreme dysphagia developed; nutrient enemata were resorted to for a short period and then gastrostomy was performed. By this means the patient was fed during two years. The gastrostomy opening had, however, been made too large and the patient suffered much discomfort and mental distress, culminating in a suicidal tendency.

The stricture, situated at a distance of 32 cm. from the teeth, was impermeable to the smallest bougie, and on examination by means of the X-rays appeared to be complete. However, on the patient swallowing a small quantity of solution of methylene blue the contents of the stomach became after a time slightly coloured. A Gasper's endoscope was then introduced through the gastric fistula and an attempt made to pass a catheter from below upwards. With much difficulty this was accomplished, and the end of the catheter being brought out through the mouth a thread was drawn down to the stomach. By means of this a flexible urethral sound was drawn up into the stricture, which it entered to the extent of a diameter of 3 mm. This was withdrawn after two hours, the thread being left *in situ*. The manœuvre was repeated on two occasions at intervals of two days, the sound gradually passing with greater readiness. Subsequently, oesophageal bougies were used instead of the sound, and by the fifth week, a dilatation of 16 mm. having been obtained, it was possible to pass the instrument from above down and to close the gastric fistula. A dilatation of 20 mm. was reached during the second month, after which the sound was passed at intervals of four weeks for a year. At the end of this period the patient was in good health and able to take food of all kinds.

*Case IV.*—The patient, a man aged 56, swallowed some caustic soda two months before. Within a month the increasing dysphagia had rendered the use of nutrient enemata necessary. Examination disclosed a permeable stricture at the junction of the upper and middle thirds of the oesophagus, and a second, apparently impermeable, stricture in the lower third. A small gastric fistula was established and a cure effected by gradual dilatation from below upwards as in the previous case. In this case, however, a cystoscope was used instead of Gasper's endoscope, and the position of the cardiac orifice, by no means easily recognizable, was rendered evident by making the patient swallow a small quantity of milk, a thin white streak marking the position of the orifice.

In all these cases injections of fibrolysin were given, and were, in the opinion of the author, of value in facilitating the dilatation. T. W. P. L.

**Vignolo-Lutati, C.** Morbo di Raynaud e sifilide (gangrena simmetrica e livedo reticulata). [**Raynaud's disease and Syphilis.**] *Morgagni*, 1919, **61**, 147.

It is generally accepted that Raynaud's disease is referable to several possible causes. The first observations suggesting the hypothesis of a syphilitic origin of the disease were published by Hutchinson in the *Medical Times* of 1884, and since that date numerous authors have reported cases lending support to the hypothesis. Thus a considerable number of cases are described in which the symptoms of Raynaud's disease were associated with signs of hereditary syphilis in children, with syphilitic endarteritis of the extremities, or with a positive Wassermann reaction. Parkes Weber reported a case (*Brit. J. Dermatology*, 1913) in which Raynaud's disease was associated with livedo reticulata, which he regarded as indicating a syphilitic basis. A somewhat similar case has come under Vignolo-Lutati's observation; livedo reticulata and purpuric patches were present, and the disease yielded to anti-syphilitic treatment.

The patient, a man aged 50, had syphilis at 30. Eight years later he began to suffer from feelings of formication and cold in the hands and feet, with pain especially marked at night. Two years later attacks of pain occurred in the toes of the right foot, ending in gangrene. Subsequently, attacks of pain with the formation of purpuric and gangrenous patches affected the dorsum of the left foot and the lower part of the leg. At the same time there appeared a purple discoloration of the skin of the thigh, abdomen, and arms (livedo reticulata or cutis marmorata). The tip of the nose, the ears, and hands became cyanotic and cold, and attacks of pain, itching, and formication occurred in the latter.

Microscopical examination of excised portions of the skin showed the existence of obliterative endarteritis of the smaller vessels, with aneurysmal dilatation and rupture of the capillaries (purpura).

The syphilitic basis of the disease was recognized late in the case and it became necessary to amputate the right foot. In the opinion of the author this would probably have been rendered unnecessary had an anti-syphilitic treatment been resorted to earlier. T. W. P. L.

**Razzaboni, G.** Gastrectomia subtotale per tubercolosi gastrica a forma pseudoneoplastica. [**Subtotal excision of the stomach for tuberculous disease.**] *Policlin.*, 1919, **26**, 153.

Razzaboni describes a case of tuberculous ulcer of the stomach treated by subtotal excision, a permanent cure resulting.

Fifteen months before the operation, the patient, a woman aged 60, who had good health up to that time, began to suffer from a feeling of weight in the stomach after meals. A few months later vomiting commenced, accompanied at times with slight haematemesis; and the patient detected a tumour in the epigastrium. The vomiting increasing in severity, great wasting and loss of strength resulted, owing to deficient nourishment. On examination, an irregular tumour of the size of an orange could be felt in the epigastric region: it was freely movable and evidently connected with the stomach. Analysis of the stomach-contents showed marked hypo-acidity. The lymphatic glands in the neck and groins were slightly enlarged and indurated. No symptoms were present indicating lung trouble.

The case was regarded as one of carcinoma of the stomach and laparotomy performed. About three-fourths of the organ was found to be diffusely thickened, the cardiac end alone being normal. The omentum was retracted, thickened, and indurated, and had a few adhesions. The affected portion of the stomach and the omentum were removed in a single mass, and the continuity of the stomach and intestine re-established by means of a double row of sutures. No enlarged glands could be felt within the abdomen.

The patient made a good recovery, and at the time of the report, three and a half years after the operation, was in good health, and her digestive functions were normal.

The portion of stomach removed was irregular on the surface owing to the presence of hard nodules, which were especially numerous along the small curvature. The omentum contained similar but smaller nodules. There was a deep crateriform ulcer near the pylorus, measuring about two inches in diameter and surrounded by a broad, raised, indurated margin. The wall of the stomach at and adjoining the ulcer was enormously thickened by fibrous overgrowth in which small gray and yellow nodules were visible. The omentum presented similar appearances. The base of the ulcer was composed of a uniform compact fibrous tissue, slightly vascularized and containing areas of dense leucocytic exudation and remnants of the muscular coat. Giant cells, surrounded with a zone of lymphocytes, were present, but in small numbers only. At a distance from the ulcer the several coats of the stomach were distinguishable, but altered to some extent by fibrosis and leucocytic exudation. The lymph follicles were enlarged. The nodules in the omentum consisted of very vascular connective tissue infiltrated with leucocytes, and giant-cell systems were more numerous than in the ulcer of the stomach. The vessels were surrounded with a dense zone of leucocytes and partially or completely thrombosed.

Razzaboni remarks that while there could be no doubt as to the inflammatory nature of the lesions, the presence of a chronic inflammatory fibrosis associated with the formation of giant cells was not in itself sufficient to exclude the diagnosis of a simple inflammation. The positive results, however, obtained from injection of sensitive animals left no doubt that the lesions were tuberculous. T. W. P. L.

## NEUROLOGY

**Boisseau, J.** Un procédé de distinction de la nature organique ou fonctionelle des paralysies radiales. Le signe de l'abduction des doigts. [**A method of distinguishing the organic or functional nature of musculo-spiral paralysis.**] *Presse méd.*, 1919, **27**, 247.

According to Boisseau, the organic or functional nature of a musculo-spiral paralysis may be readily detected by the attitude assumed by the fingers in active abduction. In *organic paralysis* the middle finger remains motionless and the index separates from it, but at the same time its first phalanx becomes flexed and the other two remain extended. The ring finger shows a similar but more pronounced movement, which is even more marked in the case of the little finger. The thumb is opposed and abducted, and is turned to the ulnar border of the hand in spite of the patient trying to carry out the opposite movement. In *hysterical paralysis* the patient, when told to separate his fingers, either says that he is unable to do so and his fingers remain motionless or the separation occurs normally as on the sound side. If he says that he is unable to carry out the movement the fingers should be separated passively and he should then be told to keep them in that position. As a general rule this method proves successful. In *mixed or hystero-organic cases* the sign of abduction of the fingers shows that the nerve lesion is not repaired, or, on the other hand, if abduction takes place normally, that the lesion is cured. The following explanation is given of the attitude assumed by the fingers in organic musculo-spiral paralysis during attempts at abduction. Normally the interossei produce (1) a movement of flexion of the first phalanges and of extension of the last two, which movement does not necessitate the extensor tendons being stretched; (2) a movement of abduction which can only take place when these tendons are stiffened by contraction of the extensors. It is therefore obvious that in musculo-spiral paralysis, while the first movement is possible, the second cannot be carried out. The efforts made by the patient involve the synergic contraction of other muscular groups, the thenar and hypothenar muscles placing the thumb and little finger in the position described. The index and ring finger respectively are passively drawn over by the displacement of the thumb and little fingers. J. D. R.

**APERT, E.** et **DECLETY.** Gynécomastie unilatérale à la suite de traumatisme des bourses. [**Unilateral gynaecomastia following injury to the scrotum.**] *Bull. et mém. Soc. méd. d. hôp. de Par.*, 1918, 3e sér., **42**, 1091–5.

A case of unilateral gynaecomastia in a soldier following a through and through wound of the scrotum is recorded by Apert and Declety. They allude to other published cases in which unilateral gynaecomastia had developed after injury to the testis, usually on the same side. In most cases the injury was slight and did not amount to destruction of the testis. In unilateral castration or extensive lesions of the testis nothing similar was seen. The writers attribute the occurrence of the gynaecomastia to the action of the nervous system upsetting the influence of the hormones regulating mammary development. The breast on removal did not show any pathological changes. J. D. R.

**SCHRÖDER, P.** Epilepsie im Kriege. [**Epilepsy in war.**] *Med. Klin.*, 1919, **15**, 229–30.

Of 97 cases of epilepsy treated in the military hospital at Greiswald during the war more than half (55) showed no aggravation of their previous attacks, 25 showed a definite increase in the number of their attacks, and 17 developed epilepsy for the first time while on military service. Of the last group some had shown an epileptoid predisposition, others had had severe injuries to the skull or syphilis. Schröder concludes that, apart from special injuries, war service cannot be regarded as the cause of epilepsy.
J. D. R.

**MIRALLIÉ, C.** Des résultats du traitement de l'épilepsie par le régime achloruré et le bromure. [**On the results of treatment of epilepsy by a non-chloride regimen and bromide.**] *Bull. Acad. de méd.*, 1919, 3e sér., **81**, 398–400.

Ever since Richet and Toulouse recommended the reduction of salt in the diet of epileptics, Mirallié has systematically employed this regimen in his hospital and private practice. Mere diminution of salt yielded inadequate results; the salt was suppressed entirely as a condiment, and the diet had to be entirely free of salt. As the suppression of salt made the nerve-cells more sensitive to the action of bromide the dose was reduced to 45 or 30 grains a day, larger doses causing very marked physical and mental depression even in patients who had previously been taking 90–120 grains a day. On the other hand, the removal of salt made the nerve-cells more susceptible to stimulants, especially alcohol, and it was frequently found that epileptic attacks which had ceased for several months returned after the threshing and vintage season, without the patient having discontinued his regimen. As a rule the attacks ceased as soon as the saltless regimen was commenced. The regimen had to be continued for a long period, at least 4 or 5 years, at the end of which time the patients were allowed to return to ordinary diet.

Generally speaking, the results were better in country people than in those living in towns, in poor classes than in the well-to-do, the reason being that among the poor the cooking is done by the mother, whereas among the rich it is done by a servant who does not realize the importance of the regimen. Among 161 patients in private practice whom Miralliė was able to keep under constant observation, 20 showed no improvement, 44 had a diminution in the frequency or severity of their attacks, and in 97 or 60 per cent. the attacks disappeared completely, some having had none for 12 years. In hospital practice, out of 12 female patients, in 3 the attacks diminished in frequency and intensity, and in 9 they disappeared. Of 10 male patients, in 5 there was an improvement, and in 5 the attacks disappeared. Their recurrence was sometimes due to alcohol or other nerve stimulants; but as a rule was caused by unintentional consumption of salt, e.g. in bread sold as saltless but really containing salt. J. D. R.

**Pagniez, P., Vallery-Radot, P., et Nast, A.** Essai d'une thérapeutique préventive de certaines migraines. [**Preventive treatment of migraine.**] *Presse méd.*, 1919, **27**, 172–4.

The writers record cases of chronic migraine which had hitherto proved refractory to every form of treatment, but which showed considerable improvement within a few weeks, and sometimes within a few days, as the result of a small quantity (7½ grains) of peptone taken half an hour before meals. J. D. R.

**Picot, G.** Le réflexe oculo-cardiaque dans les lésions traumatiques incomplètes du pneumogastrique. [**The oculo-cardiac reflex in incomplete lesions of the pneumogastric.**] *Presse méd.*, 1919, **27**, 191–2.

Changes in the oculo-cardiac reflex in wounds of the carotid region accompanied by paralysis of the vocal cord possess considerable diagnostic and prognostic value, the symptom indicating that the laryngeal hemiplegia is connected with a wound of the trunk of the pneumogastric. Inversion of the reflex reveals a destructive and doubtless permanent lesion of the nerve, while its exaggeration, as in a case recorded by the writer, appears to be due to an incomplete and curable lesion. J. D. R.

**De Lisi, L.** Contratture fisiopatiche di estremità paretiche per ferita craniocerebrale. [**Physiopathic contractures of paretic extremities from craniocerebral wounds.**] *Riv. di patol. nerv.*, 1919, **24**, 1–15.

In some wounds of the skull with crossed paralysis of the upper limb there is a physiopathic contracture of the paretic extremity. In these cases the cerebral disturbance is not sufficient to create the physiopathic con-

tracture, but the coexistence of a peripheral traumatic lesion is always required. That the cerebral factor and peripheral traumatism are not independent of one another is shown by De Lisi's case, in which a small wound which preceded the cranio-cerebral wound by about three months did not of itself produce any physiopathic disturbance, but gave rise to the *main d'accoucheur* deformity of the hand which became paretic as the result of the cortical damage a few days after the onset of the monoplegia.
J. D. R.

**Mingazzini, G.** Contributo allo studio clinico degli spasmi funzionali della lingua. [**The clinical aspects of functional hemispasm of the tongue.**] *Riv. di patol. nerv.*, 1918, **23**, 125–34.

Mingazzini records two cases. In the first, which occurred in a woman aged 71, the spasm had a chronic character and affected the tongue and muscles of the lips. The second case was that of a soldier aged 27, who after a psychical shock developed a tonic permanent spasm of the muscles of the tongue (stylo- and hypoglossus), soft palate, and part of the masseters. A brief résumé is given of the other recorded cases of isolated or associated spasm of the tongue. J. D. R.

**Giannuli, F.** Amnesia globale delle parole e paralisi omolaterale da emorragia del lobo temporale. [**Complete verbal amnesia and homolateral paralysis from haemorrhage in the temporal lobe.**] *Riv. di patol. nerv.*, 1918, **23**, 73–89.

Giannuli records an illustrative case in a woman aged 59 and comes to the following conclusions:

1. Complete verbal amnesia is a specific syndrome of lesions situated in the left temporal lobe.
2. Homolateral paralysis may form part of the syndrome of lesions of the temporal lobe.
3. This paralysis illustrates the anatomical relations existing between the temporal lobe on one side and the Rolandic area in the opposite hemisphere, which are presumably established by tracts crossing in the corpus callosum and passing through the external capsule.

The decussation of the tracts in the corpus callosum may under special circumstances neutralize the clinical and anatomical effects of the decussation of the pyramidal tracts in the medulla, giving rise to homolateral paralysis.
J. D. R.

**Chiray** et **Roger, E.** Le 'syndrome musculaire' de la sciatique. [**The 'muscular syndrome' of sciatica.**] *Bull. et mém. Soc. méd. d. hôp. de Par.*, 1919, 3e sér., **43**, 73–82.

The principal manifestations of the 'muscular syndrome' of sciatica are muscular atrophy, exaggeration of idio-muscular contractility, hypotonus, and, most important of all, changes in electrical excitability. It is only in exceptional cases that these symptoms amount to a definite paralysis; on the other hand, they frequently give rise to a muscular weakness localized to certain muscles of the leg and foot. The *atrophy* usually remains slight in sciatica. Like the other muscular symptoms, it begins and is most pronounced in the foot. As Barré has shown (vide *Medical Supplement*, 1919, **2**, 180), it is very often readily seen in the *extensor brevis digitorum*. In other cases the plantar muscles are affected. It is not till later, in the more severe and persistent forms, that the atrophy affects the muscles of the leg, such as the gastrocnemius and soleus or the peronei and tibialis anticus. Lastly, atrophy of the thigh and more frequently of the buttock may be observed.

*Exaggeration of idio-muscular contractility* in sciatica has been specially studied by Villaret and Faure-Beaulieu, who have shown that percussion of the gastrocnemii causes a larger and longer contraction on the affected side than on the sound side, giving rise to a slow and exaggerated plantar flexion, whereas percussion of the tendo Achillis causes on the contrary a weakened plantar flexion. The same writers have shown that percussion of the tendo Achillis, especially at its inner border, causes an abnormal flexion of the great toe owing to direct percussion of the tendon of the flexor longus hallucis, which passes behind the internal malleolus and is less protected than normally owing to hypotonus of the gastrocnemius and soleus. *Hypotonus*, like the other muscular symptoms, begins in the sole. It is also found in many cases in the gastrocnemius and soleus. The muscles of the back of the thigh are also affected, which gives rise to a pseudo-exaggeration of the knee-jerk.

*Changes in electrical excitability*, contrary to what is stated in text-books, are extremely frequent in sciatica, which lasts any time. Out of 175 patients examined by the writers, 92 or 52 per cent. gave normal reactions, and 83 or 48 per cent. showed some change. In two-thirds of the cases of sciatica in which the electrical excitability was normal, the tendo Achillis reflex was preserved, while in about three-quarters of the cases in which the electrical excitability was modified the reflex was lost. As regards the topography of the electrical changes, in 20 per cent. there was a simultaneous involvement of the areas of both popliteal nerves, in 14 per cent. the area of the external popliteal alone was affected, and in 14 per cent. that of the internal popliteal only. The changes ranged from the slightest degree of hypo-excitability to a pronounced partial R. D. J. D. R.

**Chiray** et **Roger, E.** 'Le syndrome musculaire' et le 'signe de la pointe' dans la sciatique. [**The 'muscular syndrome' and the 'tiptoe sign' in sciatica.** *Bull. et mém. Soc. méd. d. hôp. de Par.*, 1919, 3e sér., **43**, 129–36.

The 'tiptoe sign' which forms part of the 'muscular syndrome' in sciatica consists in the fact that in an attack of any severity the patient cannot stand on tiptoe on the affected side, or if he can do so for a short time is unable to retain this position. The difficulty of carrying out this movement is due to loss of muscular power and not to the pain caused by the movement. It is essential that the examination should be made when the patient is barefoot, as a strong boot often takes the place of a muscle.

The sign is present in more than half the cases of sciatica. Its absence indicates that the motor neurones are not involved and warrants a favourable prognosis. On the other hand its presence is a grave sign, as it signifies muscular change and a commencing or established reaction of degeneration. The movement in question requires the participation of three muscular groups, viz. the gastrocnemius and soleus, the peroneus longus, and the plantar muscles. Incompetence of any of these groups renders the movement difficult or impossible, even though the other groups are intact. J. D. R.

**Pastine, C.** La sciatica con ipertropia muscolare. [**Sciatica with muscular hypertrophy.**] *Riv. d. patol. nerv.*, 1919, **24**, 46–52.

Pastine draws attention to the occasional occurrence in sciatica of hypertrophy instead of atrophy of the muscles of the leg and thigh supplied

by the sciatic nerve. He found this hypertrophy in 10 out of 98 cases of more or less pronounced sciatica. In 7 of the cases the disease was probably of rheumatic origin, in 2 others its nature was not determined though rheumatism could not be excluded, and in 1 it followed febrile gastroenteritis. None of the cases showed any evidence of varicose veins, phlebitis, or cutaneous oedema in the limb or in the hypertrophied segment. The increase in size of the muscles underwent some variation from day to day, was more pronounced when the patient had been standing or walking for some time, and was less marked when he had been at rest for a certain period. The hypertrophy was never considerable, and did not exceed 1–2 cm.; it was much more frequent in the leg than in the thigh; it might be present in both these segments; but as a rule hypertrophy of the leg, especially the calf, was accompanied by a slight hypotrophy or normal size of the thigh. On palpation the hypertrophied muscles did not show any abnormal consistence or felt slightly hardened and a little more resistent than on the sound side. Idio-muscular contractility was almost always definitely diminished. Pressure on the muscles, especially deep pressure, was usually painful, sometimes more so than on the course of the nerve. On electrical examination the most frequent changes were merely quantitative and there was either increase or diminution of excitability. These characters seem to indicate that it was not so much a true muscular hypertrophy as a pseudo-hypertrophy, and that the principal process was a hyperplasia of the interstitial connective tissue, although a certain degree of hypertrophy of the muscular fibres could not be absolutely excluded. The cause was to be found in the inflammation or irritation of the sciatic nerve and vasomotor nerve fibres and in the circulatory disturbances resulting therefrom. During the first stage hypertrophy of the muscles takes place, and subsequently hypotrophy.
J. D. R.

**LORTAT-JACOB, L.** et **HALLEZ, G. L.** Syndrome paralytique du sympathique droit accompagnant un anévrisme des gros vaisseaux de la base du cou. [**Paralytic syndrome of the right sympathetic accompanying an aneurysm of the large vessels at the base of the neck.**] *Bull. et mém. Soc. méd. d. hôp. de Par.*, 1919, 3e sér., **43**, 137–42.

The patient, a woman aged 28, presented Claude Bernard-Horner's syndrome on the right side characterized by narrowing of the palpebral fissure, enophthalmos, and myosis. The paralysis of the right sympathetic was also shown by the absence of sweating on the right cheek and upper limb.

The exact position of the arterial lesion was difficult to determine, but it appeared to be at the junction of the common carotid and subclavian.
J. D. R.

**HAMBURGER, F.** Der psychogene Kremasterreflex. *München. med. Wchnschr.*, 1919, **66**, 461.

In many men, and even in many boys long before the age of puberty, in whom the cremaster reflex has been examined, the testicle may be drawn up on one or other side as soon as the patient sees the doctor preparing to elicit the reflex. This psychogenic form of the cremasteric reflex is apparently more readily obtained in neuropathic than in normal subjects, but Hamburger has not made a sufficiently systematic examination to speak with certainty on this point.
J. D. R.

**Rózsa, J.** Periodische-exazerbierende Okulomotoriuslähmung. [**Oculo-motor palsy with periodic exacerbations.**] *Wien. klin. Wchnschr.*, 1919, **32**, 340–1.

Rózsa records a case in a soldier, aged 20, who had been subject at regular intervals since the age of two to attacks of migraine, which had led to permanent damage to the right eye. His parents and nine brothers and sisters were healthy. Between the attacks there was complete right internal ophthalmoplegia and a paresis of the right external ocular muscles, the movements of the right eye inwards (rectus internus), upwards and inwards (superior rectus), downwards and inwards (rectus inferior), upwards and outwards (obliquus inferior), being somewhat limited. During the attacks of migraine, which lasted 24–36 hours, the paresis increased until there was complete ptosis, the right eye being turned outwards and downwards. The paralysis outlasted the pain and gradually subsided, the attack completely subsiding in 48 hours. The Wassermann reaction was negative in the blood and cerebro-spinal fluid. The number of cells in the cerebro-spinal fluid was not increased during or between the attacks, but on the other hand the blood showed an absolute lymphocytosis and distinct increase of the eosinophil polynuclear leucocytes both between and during the attacks. Another symptom was present which indicated an organic process in the oculomotor trunk, viz. exaggeration of the reflexes on the left, and greater electrical excitability of the facial nerve. This exaggeration of the reflexes on the left side might indicate a slight disturbance of the pyramidal and supranuclear facial tract on the right side. Nuclear disease was negatived by reaction of the pupil to eserine. J. D. R.

**Schoenborn, S.** Ungewöhnliche Neuritiden. [**Unusual forms of neuritis.**] *Med. Klin.*, 1919, **15**, 203–6.

I. *Trichinella neuritis.* Schoenborn, who had recently described an epidemic of trichinosis in Posen (vide *Medical Supplement*, 1918, **1**, 218), records 6 cases of trichinella neuritis characterized by paraesthesia in circumscribed areas of the cutaneous nerves, diminution or abolition of the tendon reflexes which were occasionally exaggerated as recovery took place, and electrical changes ranging from a single quantitative diminution to a partial R. D. Schoenborn concludes that it is quite justifiable to speak of a trichinella neuritis which, though it only rarely assumes a severe form, exists in a rudimentary condition in most cases of intense infection.

II. *Multiple radicular neuritis as a sequel of tuberculous meningitis.* A boy aged 11 years suddenly developed symptoms of meningitis. Characteristic cerebro-spinal fluid containing tubercle bacilli was obtained on lumbar puncture. The cerebral symptoms subsided, but about a fortnight later pains occurred in the limbs, and the nerve trunks became very sensitive on being pressed or stretched; three weeks after the onset there was no paresis, but several tendon reflexes were abolished. A week later the first signs of paralysis appeared in the trunk and limbs and took on a radicular type, which was most pronounced in the arms. At the same time attacks of vomiting and occipital pain set in at gradually increasing intervals. These cerebral manifestations exactly corresponded to secondary hydrocephalus. Six months after the onset they slowly disappeared and an irregular improvement took place in the paralysis, so that after 8 months the clinical picture resembled that of Heine-Medin's disease, although the radicular type of paralysis still predominated. J. D. R.

**Cristiani, A.** Gli impulsi suicidi nei militari psicopatici. [**Suicidal impulses in psychopathic soldiers.**] *Riv. ital. di neuropat.* (&c.), 1919, **12**, 19–21.

Cristiani, who is medical superintendent of the provincial asylum at Lucca, states that during the war suicidal impulses were noted in 4·86 per cent. of the civilian patients and in 9·64 per cent. of the military inmates of the asylum. 70·50 per cent. of the cases in soldiers occurred among those coming from the war zone, and 29·04 in those from the territorial zone. This illustrates the importance in the genesis of suicide of the aetiological complex constituted by depressing psycho-physical causes. In soldiers with suicidal impulses coming from the war zone these suicidal impulses were found in 76·06 per cent. of those with psychoneurotic forms of insanity and in 20·80 per cent. of those with degenerative forms. On the other hand, in soldiers coming from the territorial zone, these impulses were noted in 40 per cent. of those with psychoneurotic forms, and in 66·66 per cent. of those with degenerative forms. In soldiers coming from the war zone, in whom suicide is far more frequent than in those coming from the territorial zone, suicide is connected with exogenous causes which give rise to these psychoneuroses, while in soldiers from the territorial zone suicide is due to endogenous causes in the individual constitution giving rise to these degenerative psychoses. As regards the prevalence of suicide in the individual forms of insanity in soldiers, suicidal impulses were met with in 52·94 per cent. of the depressive states, in 16·58 per cent. of epileptic insanity, in 14·70 per cent. of confusional states, in 8·82 per cent. of cases of alchoholic insanity, and in 5·88 per cent. of dementia praecox. The impulse to suicide, although it represents a grave symptom which indicates a profound change in the psychical personality, does not possess an unfavourable prognosis; 76·06 per cent. of the soldiers with suicidal impulses showed complete mental recovery. Relapses were met with in 8·82 per cent. As regards the methods adopted, hanging was tried in 23·05 per cent., jumping from a height also in 23·05 per cent., sharp instruments in 14·70 per cent., firearms in 8·82 per cent., and poisoning (corrosive sublimate) also in 8·82 per cent. J. D. R.

**Oelsnitz** et **Cornil, L.** Paralysie globale des six derniers nerfs craniens et du sympathique cervical par blessure de guerre. [**Paralysis of the last six cranial nerves and cervical sympathetic from a war wound.**] *Bull. et mém. Soc. méd. d. hôp. de Par.*, 1919, 3e sér., **43**, 6–8.

The writers allude to the syndrome of the posterior lacerate foramen (vide *Medical Supplement*, 1918, **1**, 261 and 1919, **2**, 87), and the syndrome of the retro-parotid space (*ibid.*, 87), in which the last four cranial nerves are affected, and record a case in which facial and auditory nerves were also implicated. The shell splinter on passing through the external auditory meatus gave rise to a lesion of the facial nerve, probably at its exit from the stylo-mastoid foramen; slight injury was caused to the cochlear and vestibular division of the auditory nerve by damage to the petrous portion of the temporal bone, while the last four cranial nerves and cervical sympathetic on the same side were injured in the retro-parotid space.

J. D. R.

**Morawitz, P.** Über akute eitrige Perimeningitis (Peripachymeningitis). [**On acute perimeningitis (peripachymeningitis).**] *Deutsches Archiv f. klin. Med.*, 1919, **128**, 294–316.

Acute purulent perimeningitis or peripachymeningitis is probably not so rare as is supposed. In the course of a few years Morawitz saw three cases which were all due to staphylococci. The condition can be distinguished from cerebro-spinal meningitis by the following characters:

(*a*) Absence of all well-marked cerebral symptoms.

(*b*) Relative immunity of the upper part of the body and well-developed meningeal manifestations in the lower part.

(*c*) Well-marked tenderness of circumscribed areas of the vertebral column.

The presence of staphylococci in the pus obtained by lumbar puncture is suggestive of perimeningitis. Symptoms of a transverse lesion of the cord were present in only one of the three cases. In suitable cases the question of operation should be considered. J. D. R.

**Pastine, C.** Paralisi periodica famigliare, acetone nel sudore e nell' orine durante gli accessi. [**Familial periodic paralysis (acetone in the sweat and urine during the attacks).**] *Riv. di patol. nerv.*, 1918, **23**, 65–73.

This disease was first described by the Russian physician Schachnowitz in 1882, and more in detail by Westphal in 1885. Only about 80–90 cases are on record. It has been chiefly observed in Russia and Germany, and is most exceptional in Italy. Pastine records a case in a soldier aged 30. His father, an aunt, and two paternal uncles, his two brothers, a sister, and most of their children were similarly affected. His mother was immune. The paralytic attacks began at the age of 4 or 5 years. At first the lower limbs only were affected, and the attacks were of short duration and infrequent. Subsequently they became more extensive, of longer duration, and more frequent. Severe attacks which lasted about a week were followed by milder attacks lasting from a few hours to two days. The severe attacks began with a feeling of fatigue or weakness in the lower limbs; in two or three days the weakness became a more or less complete paralysis affecting not only the lower limbs but also the trunk, upper limbs, and in part the muscles of the neck and face, tongue and pharynx, and was accompanied by profuse sweating. The tendon reflexes were not abolished, but considerably diminished. The muscles showed reduction of galvanic and faradic excitability. The paralysis was most marked in the night and in the morning. In a few days it began to diminish from above downwards, the sweating entirely ceased, and the patient resumed his normal state. In the mild attacks the lower limbs and trunk were chiefly affected, the muscles of the head escaped, and there was no sweating. The sweat and urine during the attacks contained acetone, which disappeared as the paralysis subsided and was replaced by an abundant sediment of earthy phosphates. J. D. R.

**Pastine, C.** Un altro caso di paralisi periodica famigliare (acetonuria durante gli accessi). [**Another case of familial periodic paralysis (acetonuria during the attacks).**] *Riv. di patol. nerv.*, 1918, **23**, 224–32.

A record of a case in a man aged 37, who was sent to hospital with the diagnosis of periodical hysterical paralysis. The attacks were preceded by a vague sense of general weakness or of weakness in the lower limbs with a slightly painful sensation in the calves. In the course of 12–24 hours complete motor palsy set in, involving the lower limbs, trunk, upper limbs, and a considerable portion of the neck muscles. The masticatory muscles were more or less weakened as well as the pharynx, and sometimes those of articulation. Complete paralysis lasted a day or two, began to subside, returned for half or a whole day, and then disappeared rapidly. While the paralysis lasted the tendon reflexes were abolished, and the cutaneous reflexes were also lost or only just present. Sensibility, superficial and deep, was preserved. Electrical excitability, faradic and galvanic, was considerably diminished, but not completely abolished. The return of movements might begin both in the upper and lower limbs, either on one side or on the other, and not always in the inverse order to that in which it had set in. During the onset and height of the disease the urine contained acetone, which disappeared as the paralysis subsided, and was replaced by acid sodium urate.

A remarkable feature of the present case was that no other member of the family was similarly affected. J. D. R.

## PATHOLOGY AND BACTERIOLOGY

**Bullock, W. E.** and **Cramer, W.** **On a new factor in the mechanism of bacterial infection.** *Proc. Roy. Soc.*, 1919, B. **90**, 513.

This paper deals with the experimental production of gas gangrene, and starts from the well-known fact that suspensions of *B. welchii, Vibrion septique,* or *B. oedematiens* freed from toxin do not set up an infection when injected into animals of a susceptible species. When toxin is added to the bacterial suspensions and the mixture injected the disease is produced.

Since soil, the primary source of wound infection in war, does not contain toxin, the question arises: Why does gas gangrene ever occur in wounded men?

The conception that the disease occurs as a result of infection added to gross injury, loss of blood, exposure to cold and exhaustion, has been tested experimentally by the authors with negative results. The general condition of wounds, as they occur on the field of battle, was imitated as nearly as possible in mice, but gas gangrene was seldom produced. An attempt was made, therefore, to find some substance which will evoke the pathogenic powers of the causative anaerobes with certainty and regularity. Such a substance was found in the ionizable calcium salts. These when injected into mice in doses of 2·5 m. gm., together with suspension of washed *B. welchii* or the spores of *Vibrion septique* and *B. oedematiens,* lead with regularity to a fulminating fatal gas gangrene.

The aetiological importance of this observation lies in the fact that soluble calcium salts, especially the chloride, are almost constant constituents of cultivated soils. They are produced from superphosphates in the complicated chemical reactions which occur in well-tilled soil under the influence of bacterial activity. The contamination of wounds with earth appears therefore to be of a direct importance in a way not hitherto understood.

The mode of action of calcium salts has been studied by the authors, who have reached certain conclusions. They find, among other things, that direct contact between the bacteria and the calcium salt is not essential to elicit the disease. The suspension of bacteria may be injected at one site and the calcium solution at another, and, with certain limitations as to dose, the disease is produced. Again, if the calcium salt is injected first, the bacteria may be inoculated a day later in the same site and gas gangrene results. The conclusion is drawn that the calcium produces a specific local lesion which results in a local breakdown of the animal defences. The authors propose the term 'defence rupture' to describe this phenomenon.

Soluble salts of sodium, potassium, ammonium, and magnesium were tested with negative results. W. E. G.

**Yanagisawa, S. Experimental study on the mixed injection of Bacillus influenzae and various species of cocci.** *Kitasato Arch. Exper. M.*, 1919, **3**, 85.

The object of this work is to test to what extent the virulence for mice of *B. influenzae* and other bacteria may be enhanced by the simultaneous inoculation of two varieties.

The general scheme of the experiments may be illustrated by that which deals with *B. influenzae* and '*Diplococcus catarrhalis*' (described as an atypical pneumococcus).

1. Six mice were injected with 6 falling doses of *Diplococcus catarrhalis* to establish the minimal lethal dose.
2. Six mice were injected with 3 falling doses of *B. influenzae* with the same object.
3. Twelve mice in two series were injected with a fraction of the m. l. d. of *B. influenzae* and falling doses of *Diplococcus catarrhalis.*
4. Twelve mice in two series were similarly injected with a constant dose of *Diplococcus catarrhalis* and falling doses of *B. influenzae.*

Cultures were taken from the heart blood of the dead animals.

From such an experiment it is concluded that:

'The toxic action of Diploc. catarrhalis is raised 10 times by the simultaneous injection of one-twentieth of the lethal dosis of B. influenzae.'

'The toxic action of B. influenzae is raised eight times by the simultaneous injection of one-tenth of the lethal dosis of Diploc. catarrhalis.'

Similar experiments were performed with *B. influenzae* and pneumococci, streptococci, and staphylococci, with similar conclusions, but it should be noted that the pathogenicity of pneumococci and streptococci was so high for mice that the simultaneous injection of *B. influenzae* resulted only in an accelerated death. The author therefore bases his conclusions on the state of the animals after 24 hours when some were still alive.

When *B. influenzae* was combined with pneumococci or streptococci, these latter bacteria were isolated alone after the death of the mouse, but when with *Diplococcus catarrhalis* or staphylococci, *B. influenzae* was also isolated.

Further experiments combined *Diplococcus catarrhalis* with *B. dysenteriae* and with *B. paratyphosus*; also *B. influenzae* was combined with *B. dysenteriae*, but in none of these cases was any increase in pathogenicity found.

The author thinks that in the epidemic pneumonia in man, *B. influenzae* first enters the respiratory system, and if any of the respiratory cocci obtain access, their pathogenicity is much increased by the presence of *B. influenzae.* Thus is produced the fatal disease. In such cases the secondary organisms only may be isolated from the patients. P. F.

**Nicolle, C.** et **Lebailly, C.** Recherches expérimentales sur la grippe. [**Experimental investigations into Influenza.**] *Ann. de l'Inst. Pasteur*, 1919, **33**, 395.

The following experiments in the words of the authors 'prove the filter-passing nature of the virus of influenza and the susceptibility of the monkey'.

*Experiment* 1. A patient in the fourth day of influenza had an abundant clear expectoration. Of this expectoration:

(*a*) Some was inoculated under the palpebral conjunctiva and instilled into the nose of a *Macacus sinicus* monkey. The animal became ill on the sixth day. Its temperature had been rising since the inoculation and was then at its summit. 'It did not eat, appeared fatigued . . . diarrhoea was then observed; during the following days, wasting and depression.' 3 c.c. of the blood of this monkey, taken on the sixth day, were inoculated subcutaneously into a man without effect.

(*b*) Some was diluted with saline, thoroughly shaken and filtered through a Chamberland L candle. 4 c.c. of this were inoculated subcutaneously into a man; he 'fell ill on the same day as the monkey; he presented the classical symptoms of influenza, sudden onset, headache, general depression, oculo-nasal catarrh'. The temperature rose to 102° and in five days he had recovered.

Another man received 6 c.c. of the filtrate intravenously without effect.

*Experiment* 2. A man was inoculated intravenously with 3 c.c. of defibrinated blood from an influenza patient without effect.

*Experiment* 3. The abundant expectoration of another influenza patient was treated in the same manner as in Experiment 1. The 'whole virus' inoculated as before under the conjunctiva of a *cynomolgus* monkey produced no effect except a rise of temperature on the fifth day. 10 c.c. of the filtered 'virus' were inoculated subcutaneously into a man. On the sixth day he became ill, but he was not seen till three days later. 'The symptoms were those of a slight influenza; headache, depression, very slight catarrh.' There was practically no fever (99·4°).

*Experiment* 4. 10 c.c. of a filtrate of the diluted sputum of another case inoculated intravenously into a man produced no effect.

*Experiment* 5. The 'whole virus' from another case was inoculated subconjunctivally and instilled into the noses of 4 guinea-pigs without effect.

*Experiment* 6. A filtrate prepared as before from another case was inoculated intravenously into a man without effect.

*Experiment* 7. The expectoration from another case was desiccated *in vacuo*, powdered and suspended in saline. 8 to 10 drops were then introduced into the nasal cavities of two men. They remained well.

From these experiments the authors conclude:

1. The bronchial expectoration of influenza patients is virulent.
2. Monkeys are susceptible to this virus when inoculated under the conjunctivae and into the nose.
3. The virus of influenza is filter-passing. The filtered virus 'reproduced the disease' in two persons inoculated subcutaneously.
4. The virus is not present in the blood of patients.
5. Desiccation destroys the virus.

The authors found Pfeiffer's bacillus only rarely in cases of influenza. These bacilli did not pass through their filters and so could not be the virus in question.

It may be recalled that these authors are among the chief partisans of the 'filter-passing' theory of influenza as opposed to the 'Pfeiffer' theory. Without prejudicing the discussion, it may be pointed out that their view rests entirely upon the interpretation of the symptoms which followed the introduction of inflammatory bronchial exudates into the eyes of monkeys or the subcutaneous inoculation of filtrates of these exudates into man.

That such inoculations are pathogenic need not be disputed, but that the disease produced is influenza, as the authors assert, is far from proved. The authors have, in fact, failed to show by passage experiments that they are dealing with a living virus at all; neither did they even investigate the pathogenic effect of sputum from non-influenzal cases. P. F.

**Fejes, L.** Die Aetiologie der Influenza. [**The Aetiology of Influenza.**] *Deutsche med. Wchnschr.*, 1919, **45**, 653.

The author claims to have discovered in influenza sputum a filter-passing virus which is highly pathogenic for monkeys.

The sputum was collected in flasks and 'very strongly' diluted with saline. The flasks were shaken to emulsify the sputum and this was then filtered through a Berkefeld candle.

The filtrates were sterile, but upon inoculation into ascitic broth an opacity developed, and this was found to consist of minute highly refractile bodies in a state of rapid Brownian movement. The author does not, however, definitely attach any aetiological importance to these bodies.

The filtrate was non-pathogenic to rabbits and guinea-pigs, but to monkeys was highly pathogenic. An unstated quantity was always inoculated subcutaneously into two monkeys. The inoculum for the second monkey was heated to 65°C. for 1 hour to destroy the 'filter-passing virus'.

Four experiments were carried out and the monkeys which received the unheated filtrate died from 9 to 22 days later, while the heated filtrate was harmless.

The autopsies of all monkeys gave similar results. The following were the findings in the first animal, which was also the most affected: haemorrhages on the heart and pleura; bronchi full of serous blood; haemorrhages in the mediastinum, kidneys, mucous membranes of stomach and intestines, peritoneum, and dura mater. No cultural tests appear to have been made.

The author discusses whether these lesions might not be due to a toxin, but claims that the incubation period of 5 to 6 days is strong evidence of the living nature of the virus. He also doubts whether such lesions could be produced by a toxin.

Haemorrhages are a feature of influenza and are due to the virus found by the author in the sputum. P. F.

**Piras, L.** Sulla frequenza del bacillo di Pfeiffer nel muco faringeo degli ammalati di influenza. [**On the incidence of Pfeiffer's bacillus in the pharyngeal mucus of influenza patients.**] *Igiene mod.*, 1919, **12**, 1.

Sputa and pharyngeal exudates from 35 patients were submitted to microscopic and cultural examination and *B. influenzae* was found in pure culture in 21 (60 per cent.). This result occurred in cases examined within 12 hours of the onset of the disease. After this time mixed cultures were the rule. A. D.

**Besredka, A.** Du mécanisme de l'infection dysentérique, de la vaccination contre la dysenterie par la voie buccale et de la nature de l'immunité antidysentérique. [**On the mechanism of dysenteric infection, antidysenteric vaccination *per os* and the nature of antidysenteric immunity.**] *Ann. de l'Inst. Pasteur*, 1919, **33**, 301.

Dysentery bacilli do not give rise to septicaemia on intravenous inoculation, but locate themselves in the intestine from the duodenum to the terminal portion of the small intestine, as well as in the gall-bladder. Following subcutaneous inoculation the virus at first remains local and undergoes a certain amount of autolysis, the surviving bacilli being taken up in the circulation and transferred to the mucosa of the small intestine. The blood of some rabbits fed on one occasion with dysentery bacilli presents specific agglutinins which disappear after the fourth month. Repeated feeding does not increase the agglutinin content of the serum however. The serum of rabbits fed with dysentery cultures has no preventive antibodies when injected before or at the same time as the microbe. It is found, however, that the animals themselves are solidly immunized against a lethal dose of culture. According to Besredka the mechanism of dysenteric immunity is as follows: An erosion is formed in the intestinal mucosa when the bacilli arrive in the intestine. As soon as the erosion is healed a solid immunity arises, the intestinal barrage becomes insuperable, and no new antigens find access to the circulating blood. A. D.

**Schürer, J.** and **Wolff, G.** Ueber die Bedeutung der Proteus-Bazillen beim Fleckfieber. [**The relation of Proteus bacilli to Typhus.**] *Centralbl. f. Bakteriol.* (&c.), 1919, **82** (Orig.), 517.

Cultures were made from the blood of 260 typhus patients and 20 strains of *B. proteus* were isolated. Of these only 7 were found to be agglutinated by patient's serum to a high degree (Type X 19 of Weil and Felix) and 3 were moderately agglutinable (Type X 2). The rest agglutinated only slightly and were therefore looked upon as ordinary (*vulgaris*) strains, in contradistinction to X strains. The X strains were, thus, no more common in the blood of patients than ordinary strains.

Similar results were obtained with 137 cultures from the urine. It was found that when cultures approximating to X 2 strains were examined with several patients' sera, there was a considerable obliteration of the division between 'ordinary' and X strains.

No morphological or cultural differences were found between 'ordinary' and X strains.

The Weil-Felix reaction is to be looked upon as an index of a proteus symbiosis or secondary infection in typhus. The 'ordinary' proteus strains probably play as much part in this as X strains. P. F.

**Borrel, Cantacuzène, Jonesco-Mihaesti** et **Nasta**. Sur un microbe capsulé, trouvé chez le pou et l'homme atteints de typhus. Culture du microbe. [**On a capsulated microbe found in lice and in man infected with typhus. Cultivation of the organism.**] *Compt. rend. Soc. de biol.*, 1919, **82**, 501.

Thirty lice taken from typhus patients were examined and found sterile. In a second experiment 35 lice were placed on typhus patients in the first seven days of the disease. The lice were kept at a temperature of 28° C. From the 35 lice a non-capsulated coccus was isolated five times, while four showed a capsulated Gram-negative coccus with bipolar staining. This was easily grown on Bordet agar or broth, but no growth was obtained on sugar agar under anaerobic conditions. On gelatine stabs a nail-like growth was obtained. On agar involution forms were seen after 48 hours. Strains isolated from lice as well as from the meninges and conjunctival sac of patients showed the same features. Glucose, laevulose, galactose, and arabinose were fermented, while the conjunctival cultures fermented saccharose in addition. If 1·0 c.c. of a broth culture is injected intravenously into a rabbit an intense intoxication may be produced in less than 24 hours. In some cases there is weakness and paresis of the hind limbs, and rigidity of the neck. Marked congestion of the meninges is found at autopsy. The experimental disease does not assume a septicaemic form. The relation of this capsulated microbe to typhus fever is not clear, and it would seem to be the same microbe as that described by Pretjeschensky. A. D.

**Mezincescu, D.** et **Holban, D.** Sur la vitalité et la virulence des cultures du gonocoque. [**On the vitality and virulence of Gonococcus.**] *Compt. rend. Soc. de biol.*, 1919, **82**, 535.

The authors recommend ascitic agar with an acidity of 1·5–2·0 normal NaOH (with phenolphthalein) and allege that at 37° C. gonococcus will live on it for a year. The virulence is also preserved during this period.

A. D.

**Nicolle, M., Jouan, G.,** et **Debains, E.** Recherches sur les antigènes méningococciques et gonococciques. [**Researches on meningococcal and gonoccccal antigens.**] *Ann. de l'Inst. Pasteur*, 1919, **33**, 261.

The authors studied the differentiation of meningococcus and gonococcus by agglutinating sera. When the two antigens are brought into contact with their homologous sera the agglutination is specific. When, however, the antigens are treated in the manner described by Porges (extraction with hydrochloric acid and subsequent neutralization with normal NaOH) a marked difference is obtained, for it is now found that the meningococcus is no longer sensitive to its homologous serum, whereas the gonococcus antigen is unaltered. The meningococcus can, however, be rendered sensitive to antigonococcus serum if the '*C*' antimeningococcal serum (produced by the authors) is introduced into the reaction. The authors maintain that the complement fixation test is unsuitable for differentiating gonococcus from meningococcus. A. D.

**Herrold, R. D.** and **Culver, H. A study of the Gram-negative bacilli of renal infections.** *J. Infect. Dis.*, 1919, **24**, 114.

In this paper the authors describe a detailed study of 86 strains of Gram-negative bacilli isolated from renal infections. The specimens were all obtained by ureteric catheterization and subsequent plating out on blood agar. The biological and serological characteristics of the bacilli were then examined. The biological reactions tested included fermentations, motility, indol production, and action on gelatine. By these tests the 86 cultures were found to fall into two main groups: 1. Paracolon type numbering 43 strains; 2. True colon type numbering 43 strains.

In the paracolon group all strains were true to type. In the true colon group the reactions varied markedly, and by these variations they may be subdivided into four sub-groups:

1. *B. coli communis*, 15 strains.
2. *B. coli communior*, 12 strains.
3. *B. acidi lactici*, 9 strains.
4. *B. aerogenes*, 7 strains.

The serological characteristics of these bacilli were investigated by two series of experiments.

In the first series eight strains were taken, four from the paracolon group and four from the colon group. Monovalent antisera were prepared for each of these strains with a minimum titre of 1 in 1280. Cross agglutinations were then carried out. It was found in this series that all the paracolon sera agglutinated all the paracolon bacilli to titre with one exception, but that the paracolon sera had little or no agglutinating reaction when tested with the colon group bacilli. When, however, the anticolon sera are tested against the various bacilli it was found that whereas the agglutination for the homologous serum is good, there is very little or no agglutinating power for the paracolon group, or even for the heterologous bacilli of the true colon group.

In the second series of experiments two monovalent sera were made from bacilli of the paracolon group. These were used to agglutinate all the 43 strains of paracolon bacilli. By this means it was shown that, contrary to the indications in the previous series of experiments, the paracolon bacilli form a heterologous group in so far as only 18 members are agglutinated to titre by both antisera used, the other members showing only a very minor degree of agglutination.

The specific antibody reaction of organisms of this group, therefore, do not bear any fixed relation to the fermentation reactions.

Throughout this work no clinical similarity could be found between infections by any one group or sub-group.

The authors point out that a conclusion to be drawn from these observations is that in vaccine therapy for these infections the specific infecting organism must be used for immunizing purposes. G. T. W.

**Sanarelli, G.** (1) De la pathogénie du choléra. La défense naturelle du péritoine contre les vibrions cholériques. [**The pathogenesis of cholera and the natural peritoneal defence against cholera vibrios.**] *Compt. rend. Acad. d. sc.*, 1919, **168**, 69.

—— (2) Patogenesi del colera. Evoluzione della 'peritonite colerica' nella cavia. [**Pathogenesis of cholera. The evolution of cholera peritonitis in the guinea-pig.**] *Ann. d'ig.*, 1919, **29**, 1.

—— (3) De la pathogénie du choléra. Le gastro-entérotropisme des vibrions. [**The pathogenesis of cholera. The gastro-enterotropism of the vibrios.**] *Compt. rend. Acad. d. sc.*, 1919, **168**, 578.

—— (4) Patogenesi del colera. Il gastro-enterotropismo dei vibrioni. *Ann. d'ig.*, 1919, **29**, 130.

On the epiploon the leucocytes phagocytoze the vibrios and induce the characteristic granular degeneration. When the polymorphonuclear cells have completed their action they themselves are phagocytozed by the macrophages which during this second stage purify the peritoneum.

Intraperitoneal injections of lethal doses lead to a septicaemia of longer duration. The reactions on the epiploon and peritoneum are less intense and come to a standstill by the third hour. The only defence left to the body is the bactericidal action of the peritoneal fluid increased by the production of complement. Granular degeneration of vibrios is observed in the peritoneal fluids as well as in the circulation. Suddenly about the tenth hour diapedesis of polymorphonuclears appears, and they display active phagocytic properties on the surface of the mesentery, but none the less the animal succumbs.

The two papers (1, 2) are on the same subject, viz. the development of cholera peritonitis following the inoculation of *V. cholerae.* Already an enormous amount of work has been done on this phenomenon by Pfeiffer, Metchnikoff, Isaeff, and others, but the author puts the pathology of experimental cholera in a new light.

After inoculation of a non-lethal dose of living cholera vibrios into the peritoneum of the cavy the microbes pass through the lymphatics and gain the blood stream, where they occasion a transient septicaemia lasting only twelve hours. The leucopenia in the peritoneum is not the result of cellular destruction as has been supposed, but is due to the fact that the leucocytes congregate on the surface of the epiploon, where they form layers and constitute an efficient barrage to the further passage of vibrios into the blood.

In subsequent communications (3) (4) Sanarelli studies the mechanism of fatal cholera peritonitis in the guinea-pig. He points out that when cholera vibrios, digested, dead or living, are injected into the peritoneum an inflammatory process is set up in the intestinal mucosa and the animal dies of gastro-enteritis, the severity of this lesion depending on the number of bacteria which are able to pass the mesenteric barrage or on their toxicity. In his view neither the peritonitis nor the blood infection kills the animal. The excretion of vibrios through the intestinal mucosa also produces oedema in the submucosa and interglandular tissue, degeneration of the gland follicles, watery or muco-serous fluid, and achlorhydria. Thus the gastric juice becomes alkaline and the vibrios reach the stomach and multiply abundantly. Removal of the mesentery increases the gravity of the gastro-enteritis. In cases of infection of low virulence the bucco-pharyngeal mucosa becomes one of the routes through which the vibrios escape. In cases of prolonged evolution and ending fatally he observed a form of intestinal paralysis resembling the cholera siccum of human pathology.

A. D.

**Fasiani, G. M.** Sulla pretesa trasformazione dei germi anaerobi delle gangrene gassose. [**On the alleged transmutation of anaerobic bacteria in gas gangrene.**] *Sperimentale. Arch. di biol.*, 1919, **72**, 459.

Some years ago remarkable statements were published by Grassberger and Schattenfroh, who claimed that they had witnessed the transformation of one anaerobe into another, and this was accepted as a fact by many of the German bacteriologists although now known to be erroneous. The error no doubt occurred through defective technique and an inability to obtain pure cultures, and has been continued down to recent times in the work of Conradi and Bieling, who sought to prove that gas gangrene is an aetiological entity caused by a variable microbe which they named *Bacillus sarcemphysematodes.* The apparent variability has been demonstrated during the war by French and English bacteriologists to be due to the existence of several species of bacteria entirely different in their cultural, morphological, and pathogenic properties. The work of Fasiani confirms this view. By means of efficient technique he was able to isolate various microbes which had fixed characters and were not capable of transformation.

A. D.

**Vincent, H.** et **Stodel, G.** Les résultats du traitement de la gangrène gazeuse par le sérum multivalent. [**Results of the treatment of gas gangrene by polyvalent serum.**] *Compt. rend. Acad. d. sc.*, 1919, **168**, 188.

The serum employed was obtained from horses injected with *B. per-*

*fringens*, *B. oedematiens*, *B. bellonensis*, *B. putrificus*, *B. sporogenes*, and also *B. tetani*. As a preventive dose 20 c.c. were employed, while for cure a dose of 60 c.c. was given, and repeated if necessary after 12 to 18 hours. After the injection of the curative dose there was a rapid improvement in the general as well as the local condition. The fever abated, the urinary secretion was increased, and the gas invading the tissues disappeared. In a series of 81 patients treated the mortality was 14·81 per cent. A. D.

**Richet, C.** et **Cardot, H.** Mutations brusques dans la formation d'une nouvelle race microbienne. [**Abrupt mutations in the formation of a new microbic variety.**] *Compt. rend. Acad. d. sc.*, 1919, **168**, 657.

The authors accustomed a lactic ferment to grow in whey, to which 2·66 per cent. of potassium arsenate ($K_3AsO_4$) was added. If the arsenic-fast race is inoculated into media without arsenic it is found to have retained certain of its characters, for after being in the arsenic-free medium for nine generations it will grow well on an arsenic-containing medium, whereas the normal organism will not grow at all. The adaptation of the normal microbe to the arsenicated medium is not progressive, but like the variations of de Vries. The signs of adaptation are seen in the sudden and intense multiplication of the microbes which occur from time to time in the arsenicated medium. A. D.

**Eisenberg, Ph.** Ueber die diagnostische Verwendbarkeit der Säureagglutination. [**The diagnostic value of acid agglutination.**] *Centralbl. f. Bakteriol.* (&c.), Abt. 1, Orig. 1919, **83**, 70.

The author followed the general technique of Michaelis, but instead of confining himself to a range of 6 tubes with an H concentration of $0{\cdot}9.10^{-5}$ to $2{\cdot}8.10^{-4}$, he continued the higher concentrations with 4 tubes to $4{\cdot}4.10^{-3}$.

He examined 163 strains of Typhoid. 84 per cent. of these gave 'regular' reactions with an optimum in tubes 2 to 4. Such reactions were not, however, quite constant even among the 'regular' strains; sometimes the optimum was in another tube, this result being due possibly to slight variations in the conditions of growth.

By means of the extended scale of H concentrations, he found that the 138 'regular' strains were divisible into 2 groups. In one (91 strains) the optimum was in tubes 2 to 4 only, while in the other (47 strains) two optima were found, one in tubes 2 to 4 and another in tubes 6 to 10. This latter subgroup of the 'regular' strains was looked upon as intermediate between the true 'regular' and 'irregular' strains.

15 per cent. of the Typhoid strains were 'irregular':

11 strains showed an optimum in tubes 6 to 10 only.

10 strains showed an optimum in tubes 5 or 6.

4 strains were inagglutinable.

An optimum in tubes 5 or 6 is, according to Michaelis, characteristic of Paratyphoid B, and thus from a practical point of view acid agglutination of Typhoid is neither constant nor specific.

9 strains of Paratyphoid A were examined; of these 7 gave the characteristic optimum for Paratyphoid B in tubes 5 or 6, while 2 were inagglutinable. To illustrate the inconstancy of this method, one strain was examined 17 times, with 7 characteristic results and 10 failures to agglutinate.

Among 73 Paratyphoid B strains, 54 gave 'regular' results, although for the most part the reaction was slight; 5 strains gave the typhoid reaction with 1 optimum, and 1 gave the 2 optima result; 11 strains gave the optimum in the higher concentrations of acid, while 2 strains were inagglutinable.

17 strains of Gaertner's bacillus gave similarly inconstant results.

With regard to Colon bacilli, Michaelis had originally described these to be inagglutinable, but later, as a result of the addition of small quantities of serum, he had been able to induce agglutination. The optimum varied according to the amount of the added albumen. This albumen-acid agglutination differentiated Coli from dysentery bacilli, since these remained inagglutinable even after the addition of albumen.

The present author examined 182 Colon strains, namely 139 lactose fermenters and 43 non-lactose fermenters which he describes as 'Paracoli'.

Only 28 per cent. of these Colon strains were found to be inagglutinable, while those which agglutinated showed similar varieties of optima to those already described.

The addition of serum (1 in 2000) had a similar effect upon the acid agglutination of Coli as upon the agglutination of the typhoid-paratyphoid groups. Various anomalous alterations appeared, and generally the optimum range was broadened and extended towards the lower H concentrations. If larger quantities of serum are added, all inagglutinable strains of Coli will react positively. The author also examined a number of dysentery cultures. Among 60 Shiga strains, 47 were 'regular' in that they were inagglutinable either without or with serum; 12 reacted in the high acid concentrations (tubes 7 to 10), while 1 reacted like Paratyphoid B (tube 5 or 6).

Of the 13 Flexner strains 5 were inagglutinable and the rest reacted in different ways 'characteristic' for other bacteria. 10 Y strains and 3 Strong gave similar results. In the case of dysentery bacilli the addition of serum hardly ever induced acid agglutination.

Other bacteria (*B. faecalis alcaligenes, cholerae, pyocyaneus*, &c.) gave very similar results to those described for the typhoid-colon-dysentery group.

Thus acid agglutination in the case of these bacteria is not constant enough and not specific enough to found a diagnosis of a doubtful strain upon it alone. P. F.

**Noguchi, H. Etiology of yellow fever. I. Symptomatology and pathological findings of the yellow fever prevalent in Guayaquil. II. Transmission experiments on yellow fever. III. Symptomatology and pathological findings in animals experimentally infected.** *J. Exper. M.*, 1919, **29**, 547, 565, and 585.

The first of these papers describes the clinical and pathological findings in those cases under examination, in order to show that they were typical instances of yellow fever.

74 guinea-pigs were inoculated intraperitoneally with blood drawn from these patients, and 8 animals, inoculated with material from 6 cases, developed symptoms which were considered to be due to a yellow fever infection, namely, a marked rise of temperature after an interval of 3 to 6 days, suffusion of the conjunctivae and soles, and albumen and casts in the urine. The fever lasted a few days, and, as it declined, the animals became jaundiced and haemorrhages occurred from some of the mucous membranes. At the autopsy comparable lesions of the internal organs were found.

Inoculations were less successful when fresh blood was used than when it was incubated at 20–25° C. for 3 days in a Ringer (3 parts)-human serum (1 part) medium containing 0·3 per cent. of agar and covered with paraffin.

In the blood, liver, and kidneys of the animals a spirochaete was found by dark ground illumination, which closely resembled *S. icterohaemorrhagica*. The author names it '*Leptospira icteroides*'.

Successive passages of the virus were made with suspensions of organs of affected animals and with cultures of the spirochaete after numerous subcultivations, but no details are given of the methods employed.

The disease in guinea-pigs was not always fatal, and when recovery occurred, the animal was found to be refractory to subsequent inoculation.

Experiments with ringtail monkeys, rabbits, cats, dogs, donkeys, and other animals and birds were not successful, but later (paper III) dogs and marmosets succumbed to the infection with the same symptoms and pathological changes as the guinea-pig.

The third paper describes these symptoms and pathological changes, and shows that they are very similar to those observed in man affected with yellow fever as described in the first paper. P. F.

**FLEXNER, S.** and **AMOSS, H. L. Persistence of the virus of poliomyelitis in the naso-pharynx.** *J. Exper. M.*, 1919, **29**, 379.

The possibility of the spread of poliomyelitis by abortive cases of the disease had been indicated by Wickman, but the virus had been demonstrated in the naso-pharynx of such persons in only a very small number of cases.

A series of inoculations into monkeys of secretions from the naso-pharynx of recovered cases was undertaken by Kling, Pettersson, and Wernstedt, and they had concluded that it was common for such to become chronic 'carriers'. The present authors, however, claim that the criteria of experimental poliomyelitis in monkeys set up by Kling, Pettersson, and Wernstedt differ from those accepted by other workers and thus doubt the validity of their conclusions.

Emulsions of tonsils, of pharyngeal and nasal mucosa from 14 fatal cases were inoculated into monkeys, and allowing for experimental discrepancies, the virus was constantly demonstrated. The specimens were taken within the first 10 days of the disease.

Tonsils and adenoids were also removed surgically from 20 patients suffering from non-fatal attacks of poliomyelitis, and in these the virus was seldom demonstrated. This material differed from that derived from the fatal cases in being, almost without exception, older, that is to say, the infection had lasted a longer time.

The authors note that the higher rate of positive results in the fatal cases may be due to the fact of death, but conclude from their experiments that the infectivity of patients is greatest in the early stages and that it rapidly decreases afterwards. Chronic carriers are to be looked upon as rare. P. F.

**THOMSEN, O.** Die Bedeutung des Komplementes für den anaphylaktischen Schock. [**The relation of complement to anaphylactic shock.**] *Centralbl. f. Bakteriol.*, (&c.), Abt. 1, Orig. 1919, **83**, 51.

According to Friedberger and others anaphylactic shock is due to the effect of complement and antibody upon an antigen producing a poisonous degradation compound.

The author studies to what extent complement is actually affected during the occurrence of shock.

Authorities are agreed that when antigen is injected into a passively immunized animal, there is a great loss of complement in the circulating blood, but in the case of actively immunized animals most consider that the loss of complement is much less or is more protracted, so that it continues after the shock has occurred or even after the death of the animal. They look upon the loss of complement as inessential in the production of shock; only Friedberger holds that a pronounced loss of complement occurs at the time of the shock in an actively immunized animal.

The author finds that much misconception has arisen through technical errors in the estimation of the loss of complement. It has been customary to use a certain scale of dilutions of complement for this purpose, and he points out that this scale is extremely irregular when expressed in the form of *units* of complement, so that when a serum falls in certain parts of the scale, an alteration in its titre may easily pass undetected. The titre of complement should always be expressed as units and not as absolute quantities.

In this way he demonstrates that a loss of complement is not constant in either actively or passively immunized guinea-pigs subjected to shock. It is, however, more pronounced in passively immunized animals, although it is not proportional either to the degree of susceptibility of the animal or the intensity of the shock.

The loss of complement is proportional to the amount of free antibodies circulating in the blood (precipitins). It is insignificant when the animal has been sensitized with a single small dose of antigen, but when the guinea-pig has been prepared with repeated doses and the precipitin content of the blood is high, the loss of complement after the shock is marked.

Thus shock cannot be due to an essential co-operation of complement as held by Friedberger. P. F.

**Richet, C., Brodin, P., et Saint-Girons, F.** De l'action immunisante du chlorure de sodium contre l'injection anaphylactique déchaînante (thérapeutique métatrophique). [**On the immunizing action which chloride of sodium manifests on the determining anaphylactic dose (metatrophic therapy).**] *Compt. rend. Acad. d. sc.*, 1919, **169**, 9.

The dog, as is well known, reacts promptly and constantly in anaphylactic experiments with serum. The authors find that if instead of re-injecting pure plasma one re-injects a mixture of nine parts of saline (0·8 per cent.) and one of plasma the anaphylactic reaction does not occur. That this is not due to the menstruum is shown by the fact that anaphylaxis occurs when glucose solution or saline (0·4 per cent.) are employed or if the plasma is diluted only five times with the 0·8 per cent. solution of sodium chloride.

The injection of 0·8 per cent. saline alone 48 hours or even just before the re-injection of the plasma does not prevent the occurrence of the reaction, but when a large quantity of salt (3·6 grammes for a 9 kilo dog) is injected half an hour before the re-injection of plasma a condition of anti-anaphylaxis becomes manifest.

It would appear that the sodium chloride has a preventive or immunizing action which the authors explain thus. The nerve cells quickly become impregnated with the salt injected into the circulation and the absorption of serum or plasma to provide the outburst of anaphylactic symptoms does not occur. It seems to be the converse of the action of saline hunger, which Richet found makes the animal more sensitive to poisons. A. D.

**Cramer, W. Observations on the functional activity of the suprarenal gland in health and in disease.** *Sixth Scientif. Report Imp. Cancer Research Fund,* 1919.

The observations are based on the conception, formulated by the author in previous papers, that the thyroid and adrenal glands form a humoral apparatus for the heat regulation of the body. This conception is summarized in the introduction as follows: The thyroid hormone stimulates the secretion of adrenalin from the adrenal. This produces on the one hand a discharge of glycogen from the liver which leads to a general rise in metabolism and thus to an increased heat production. On the other hand, an increased secretion of adrenalin, if sufficiently strong, will contract the arterioles and thus diminish the heat loss.

The present paper deals with the application of this conception to a number of pathological conditions, associated with disturbance of the heat regulation of the body, namely: bacterial infections associated with a pyrexia on the one hand and with a sub-normal temperature on the other, experimental fever produced by the injection of tetrahydronaphylamine, and exposure to cold. Other conditions which have been investigated are shock, haemorrhage, anaesthesia, experimental hyperthyroidism produced by feeding with thyroid gland, and acidosis.

The functional activity of the suprarenal gland was studied by means of a new histochemical reaction which depends on the fixation of the gland in osmic vapour. By this method the fine adrenalin granules in the medullary cells are stained a deep black, and it is possible to follow their passage from these cells into the central vein when the gland is stimulated to activity. At the same time the histological details of the gland are preserved. The appearances of the gland at rest and in different stages of functional activity are described in detail and illustrated by drawings.

A peculiar and important feature of the activity of the gland is the flexibility with which the gland responds to a stimulus not only by the secretion of adrenalin but also by a corresponding new formation. This 'self-regulation' leads to the result that with a slight or even moderate stimulus the gland remains always loaded, although it may be secreting continuously. This occurs, for instance, in certain bacterial infections, such as a streptococcal abscess, and in exposure to cold of a moderate degree of severity. If the stimulus is strong and prolonged, as for instance in severe exposure to cold, the new formation of adrenalin may not keep pace with the rate at which it is poured into the blood stream. Then there is a partial or even extensive depletion of the gland from which it recovers when the stimulus is withdrawn.

An inhibition of the new formation of adrenalin is postulated for a number of different conditions in which a depletion of the gland occurs without an antecedent hyperactivity. This occurs in the terminal stages of such bacterial infections as gas gangrene or a virulent streptococcal septicaemia. Anaesthesia, acidosis, and haemorrhage have a similar but less pronounced effect.

The suprarenal gland is therefore an organ the functional capacity of which may be called into action by a great variety of different conditions, of which the one connected with the heat regulation of the body is almost always operative. A number of very different conditions when present together may thus reinforce each other in their effect on the organism by their joint action on the suprarenal gland. To any one of these when acting alone the gland may be able to respond with an increased activity, so that even with a gland temporarily depleted the animal may resist the condition without manifesting serious symptoms. But a combination of several such conditions operating together may overtax the functional capacity of the gland and produce a complete exhaustion of the same. Then collapse ensues with symptoms resembling shock, and the animal dies. Such a combination of conditions was particularly likely to occur in wounded men, more especially when gas gangrene supervened. This condition of collapse, which is often described as shock, is different from that of true post-operative shock as studied in animals, in which it developed in the course of an abdominal operation, as the result of excessive handling of the intestine. In true post-operative shock the suprarenal gland is loaded with adrenalin and actively secreting it at the very moment when the animal dies with a low blood-pressure and a sub-normal temperature. Post-operative shock is therefore a condition *sui generis.*

Observations were made on pathological changes in human suprarenal glands in different conditions, for which only formalin fixed material was available. A congestion of the gland affecting especially the medulla and the zona reticularis is looked upon as the most significant indication of an actively secreting gland. Examples are given which show that in conditions characterized by a severe pyrexia, such as influenza and malaria, there is frequently an intense congestion of the gland which may amount to haemorrhages into the gland. An increased functional activity of the suprarenal gland is accompanied by morphological changes in the thyroid gland which are briefly described and figured.

It is indicated how these conceptions bear upon the rational treatment of the various conditions. The importance of the application of warmth in the treatment of wounded men is particularly emphasized. It is pointed out that the conditions of modern war put a more severe strain on the suprarenal gland than any other organ, and that the strain of which this gland can be most easily relieved is that concerned with the heat regulation of the body. W. C.

**Schmidt, C. L. A.** and **Hoagland, D. R. Table of $P_H$, H+ and OH— values corresponding to electromotive forces determined in hydrogen electrode measurements, with a bibliography.** *University of California Publications in Physiology*, 1919, **5**, 23.

This paper briefly refers to the bases of all hydrogen electrode measurements, e. g.:

*a.* Numerical examples of $P_H$ calculations (Sörensen's method).
*b.* Calculation of hyd. ion concentration given the $P_H$ value.
*c.* Numerical examples of Nernst's equation.
*d.* Temperature and pressure corrections for E. M. F.

The authors also give a complete set of tables correlating E. M. F., $P_H$, $C_H$, and $C_{OH}$. The values are based on the use of either the normal or the N/10 KCl-calomel electrode. Unfortunately they are not in favour of the saturated KCl-calomel electrode, and hence have not supplied the corresponding $P_H$, $C_H$, and $C_{OH}$ values.

Finally the authors have collected together a very exhaustive bibliography on the whole subject of indicators, buffer mixtures, and the determination of Hydrogen ion concentrations. The list of references is brought up to the date of publication (March, 1919), and should prove of great use to workers in this subject.

The authors adopt the following figures as standards:—

(i) Dissociation constant of water $= K_w = 1{\cdot}012 \times 10^{-14}$ (25°C.).

(ii) Hyd. Ion-conc. of water $= \sqrt{K_w} = 1{\cdot}006 \times 10^{-7}$.

(iii) Potential of normal KCl-calomel electrode $= 0{\cdot}283$ volt referred to the potential of the normal hydrogen electrode as zero.

(iv) Potential of the N/10 KCl-calomel electrode $= 0{\cdot}053$ volt.

(v) Nernst's equation $\pi = \frac{RT}{nF} \log_e \frac{1}{C_H} = 0{\cdot}059 \log_{10} 1/C_H$.

(vi) Pressure and temperature corrections are also given. W. A. M. S.

## PHYSIOLOGY OF FLYING

**Hirschlaff, W.** Giebt es eine Fliegerkrankheit? [**Does Flying cause Disease?**] *Berl. klin. Wchnschr.*, 1918, **55**, 350.

Hirschlaff, as medical officer to the School for Flight Observers at Königsberg, had the opportunity of examining more than one thousand flying pilots and observers, officers as well as non-commissioned officers, who had been ordered to the school direct from the front, or in order to recuperate.

Before the war, sailing in balloons and flying were pursued as sports, and the physiological disturbances consequent upon ascent to great heights were observed by Zuntz, Löwy, von Schrötter, and Koschell. Renewed attention to the subject was forced upon physiologists and medical officers by the demand for an increased rate of flight and greater rapidity of ascent in the manœuvres of war. There have been in consequence greater physiological, and to a certain extent pathological, disturbances. The chief physiological observations relate to:

1. Changes in atmospheric pressure;
2. Diminution of oxygen;
3. Fall in temperature.

**1. Changes in atmospheric pressure.** At a height of 5,000 m., and it is only in exceptional instances and for military reasons that an ascent to 6,000 m. is required, the atmospheric pressure is one-half of that on the earth. Whilst there is no evidence that the reduction of atmospheric pressure to one-half causes any mechanical injury, Koschel and others have remarked that as the result of this reduction, gases in the intestine increase to double the previous volume. If, beforehand, the intestine contained a considerable amount of gas, this expansion may result in pressure upwards upon the diaphragm so as to hinder breathing. The rapid change in atmospheric pressure, even more when descending than when ascending, may cause pain in the ears and temporary deafness. Most airmen soon learn to equalize the pressure on either side of the membrana tympani by yawning or by swallowing, so as to open the Eustachian tubes. But pain in the ear may persist if the tube is not fully patent, as also pain in the frontal sinus and maxillary antrum when communication with the nose is impaired.

**2. Diminution of oxygen.** The diminution of the partial pressure of oxygen is the chief cause of trouble to airmen. The height at which the partial pressure of oxygen becomes so low as to be incompatible with life is well above the height generally reached. But the level above which difficulties owing to lack of oxygen begin is one which varies with the individual. Experience shows that the majority of airmen do not suffer when flying at 5,000 m. But as demands for higher flights become greater, so must the physiological need for oxygen as quickly follow.

**3. Fall in temperature.** Variations in temperature are great and rapid. A fall of 6° C. in an ascent of 1,000 m. is not uncommon. A difference of 25° C. between that on the earth's surface and that at the height flown on military service is of frequent occurrence. From an agreeable temperature on the ground of 10° to 15° C. the airman passes at a low height into the cold of winter. The more rapid the flight, the more does the cold draught overcome the sun's influence. Whilst warm clothing can be used for protecting most of the body, the face and hands are more exposed, and hence the frequency with which frost-bite is experienced on these parts.

As to the pathological changes which may result from physiological disturbances as in mountain climbing or sailing in balloons or airships, and are due to the rarefaction of the air, it is surprising that although during the war an ascent to 5,000 m. was frequently made, most of the flyers had no experience of trouble, and had only a theoretical acquaintance with the oxygen-supply apparatus, which they had never had a call to use. The organism is capable of compensating for the changes in the atmospheric pressure and for the diminished intake of oxygen by greater activity on the part of the lungs and heart. The rate of respiration and the rate and force of the heart are increased.

In 214 cases the blood-pressure, as taken by the Riva-Rocci apparatus, was observed immediately before and directly after an ascent to more than 2,000 m. followed by a rapid gliding descent. In most a rise of 20 mm. Hg in the blood-pressure was shown, which lasted for the best part of half an hour after landing. But this was subject to individual variations, and in some flyers, even after an ascent to 4,000 m., followed by a rapid descent, there was no change in the blood-pressure.

These results agree with the observations of others ; even in the course of rapid ascent a rise of blood-pressure was noted. They differ from Ferry's observation, who said there was a fall of 5 mm. Hg during ascent with a rapid return to the normal, followed by another similar fall during descent. Hirschlaff invariably observed a rise of blood-pressure ; there were marked individual variations ; in one instance the rise was over 40 mm. Hg and lasted more than an hour. Variability was marked amongst those subject to nervous wear and tear. Pathological changes in the heart as the result of flying must be most emphatically denied. A spreading of the area occupied by the left side of the heart, as shown by percussion and by the X-rays, results, from an active life ; but that this hypertrophy from work is the commencement of signs of cardiac insufficiency has never been observed.

Flying men often complain of palpitation, pricking in the cardiac region, and sensations of oppression, but these are signs of general nervous debility. All that has been written on the so-called war-heart by others applies to the heart of flying men, in whom the hypertrophy due to work recedes when the activity which caused it comes to an end.

In three cases under observation for 3, 4, and 5½ months respectively, simple garrison duty with rare flights caused the previous hypertrophy to disappear.

The only case in which a temporary insufficiency manifested itself was in a pilot, aged 39, who made in the course of a few days a great number of flights. Without signs of any other illness, he landed one day after a flight reaching 2,800 m. in a state of acute cardiac weakness, almost pulseless, cyanosed, with signs of acute oedema of the lungs, and icy-cold extremities. He recovered in about an hour. Observations repeated for several weeks showed only a slight hypertrophy of the left side of the heart. After some weeks' rest, he recommenced flying near his home either alone or as a pilot, without any trouble.

In the case of two flyers, aged respectively 40 and 42 years, a dilatation of the commencement of the aorta was noticed. In neither case was there a history of syphilis and the Wassermann reaction was negative. It is by no means certain that this was due to flying, but it is not unlikely, and so worth noting.

By far the chief injury that airmen experience is the strain upon their nervous system when flying. The tense attention, the fight with the elements, the insidious character of the object aimed at, and the activity of the enemy have an extraordinary irritating and depressing influence. The appearance of nervous exhaustion, in varying degrees down to neurasthenia, is very common. The chief complaints are sleeplessness and restlessness. They experience whilst flying a feeling of uncertainty, anxiety, a sense of oppression, which gradually increase. They exhibit the typical signs of neurasthenia, increased reflexes, and nearly all an irregularity of the heart's action, which is exaggerated by the belief, from which it is difficult to dissuade them, that the flying has caused actual disease of the heart.

It is remarkable that flyers, even after a severe accident, were not observed to show signs of traumatic neurasthenia. In numerous cases in which severe injuries had been sustained by accidents whilst flying, there were no signs of traumatic hysteria, tremors, shakiness, nor functional paralysis. Amongst the badly injured of volunteer airmen, there were no war-neurotics. Zeal carries all before it and affords negative evidence of the influence of the will as regards the origin of war neuroses. The resolution to volunteer for a dangerous service submerges all the weaker elements in their nervous systems.

Among the symptoms of nervous exhaustion some are noteworthy: sexual impotence may appear in quite young individuals; the hair turns grey early; there is a tendency to micturition, for some 30 per cent. complain of weakness of the bladder, even of complete incontinence of urine whilst flying. In five such cases there had been no previous gonorrhoea, nor did the fullest examination disclose any objective disease. In two cases, in spite of the customary passage of urine and defaecation before the flight, immediately on commencing to fly a desire to pass urine arose. Very many flyers agreed that during flying they had irresistible micturition. In cases of nervous exhaustion this is present, even when not flying. It is not uncommon for there to arise an over-sensitiveness to the noise of the motor, and to the smell of oil and benzene, things to which every beginner has to become accustomed.

A very noteworthy observation about the nervous exhaustion is the remarkable pallor suggesting anaemia. But in 37 cases of men who had been flying more than a year, the haemoglobin was always over the normal; in one case it was 110 per cent. Also the red blood corpuscles showed an increase, varying between 5,300,000 and 6,500,000 per c. mm. Like living in high situations, prolonged flying acts as a stimulus upon the blood-forming organs. An increase of lymphocytes was observed, but not an increase of nucleated red blood corpuscles. There was no swelling of the liver nor of the spleen. No previous illness accounted for the pallor, which was attributable to peripheral vasomotor disturbances.

An interesting disturbance is experienced by both certificated pilots and observers, and especially by the former. They lose the sense of equilibrium during flying; they cannot judge the relation of their line of flight to the ground even in clear weather. The very interesting observations of Gartens have shown that the sense of position is in relation with atmospheric pressure, muscular sensations, the semicircular canals, and also the eye. He emphasized the importance of the eye and the inferiority of the human eye as compared with that of a bird. The importance of the eye for judging position is experienced when flying into a fog, when it is impossible to distinguish between the position of the sky and of the earth. In three cases who complained that their sense of position when flying had become uncertain, general nervous symptoms were present, especially muscae volitantes. On the disappearance of their nervous symptoms assurance as to their sense of equilibrium returned.

Cases of restlessness, giddiness, movements due to fear or irresistible movements were not met with, nor mental depression from loneliness when flying by oneself.

The existence of a disease specially due to flying was not confirmed. The symptoms which may arise when flying are the same as affect men in mountaineering, in balloons, airships, and exhibitions of flying. As far as pathology is concerned, flying furnishes nothing new; it is the harm done by accidents, quite apart from injuries in war, which continues so important. W. G. S.

## RADIOGRAPHY

**Plant.** Ueber schlaffe Herzen im Röntgenbilde (zugleich zur Beurtheilung des Lehbeschen Phänomens). [**Flaccidity of the heart.**] *Fortschr. a. d. Geb. d. Röntgenstrahlen,* 1918, **26,** 17.

The essential features of Lehbe's phenomenon is that the long axis of the normal heart in forced expiration is approximately parallel to its position in forced inspiration, whereas in flaccidity the long axis in forced expiration is at a considerable angle since the organ lies 'like a shapeless mass or a lump of clay upon the diaphragm'. P. has found that this phenomenon is frequently associated with the evocation of systolic murmurs or the weakening or diminution of the second sound at the base as the result of muscular exertion, and concludes that the two are interrelated. Since obscure symptoms possibly referable to the heart are difficult of diagnosis and may easily be regarded as due to malingering, radioscopic

evidence in one direction or the other is often of great value. Tables are given analysing 196 cases considered from the dual point of view of radioscopic evidence and clinical evidence. Seventy-four per cent. of the clinically 'bad' hearts showed the expiratory flattening, while 63 per cent. of the clinically 'good' hearts showed its absence. Lehbe's phenomenon does not appear to vary as a physiological characteristic of age.
W. S. L.-B.

**Wolff.** Die sogenannte Diverticulitis des Colon und ihre Diagnose durch das Röntgenbild. [**The so-called diverticulitis of the colon.**] *Fortschr. a. d. Geb. d. Röntgenstrahlen,* 1919, **26**, 153.

Apart from the true congenital diverticula of the intestine, false diverticula of mucosa and submucosa through the muscular coats of the gut have long been recognized. Graeser, 1899, described their minute anatomy and formation in full. One of the chief seats of their formation is the sigmoid flexure, where the progression of the intestinal contents is slow, and in connexion with the various inflammatory conditions of the large intestine they are liable to be the seat of focal inflammation and originate a series of symptoms which is said (Schmidt) to be characteristic. In 1914 de Quervain described the X-ray appearances in such a case and succeeded in showing the existence of the diverticula by means of a barium injection and a radiograph. In 1915 two examples of the condition were published in America by Case and by Carman. W. adds the description of four cases from von Bergmann's clinic with diagrams of the radiographic findings. The actual diagnosis of these diverticula must not be made without care, as subsequent examination of a colon in which they were supposed to be present may show that the appearances were due to an abnormally small amount of intestinal contents: with further distension of the gut they may disappear. It is only when the radiological appearances are found to persist on repeated examination at intervals that the existence of these false diverticula can be asserted with confidence. The paper has a good literature.
W. S. L.-B.

**Wolff.** Ein Fall von angeborenem Schulterhochstand. Kasuistischer Beitrag. [**Congenital elevation of the shoulder.**] *Fortschr. a. d. Geb. d. Röntgenstrahlen,* 1918, **26**, 26.

A short description, with two photographs and an excellent radiograph, of a girl aged 9 in which this condition obtained. According to Hayashi and Matsnoka (*Deutsche Ztschr. f. Chir.,* 1912, 113), of the 126 recorded cases in the world's literature, 93 showed other coincident deformities of the most varied kind, but chiefly spinal curvature. W.'s case was associated with deficiency of two upper incisors, a cervical rib, a deficiency of one rib on the left side, ankylosis of certain ribs, an occult spina bifida of the seventh cervical vertebra, and scoliosis. No other members of the family suffered in this way, but the condition is known in some instances to affect several members, so that Neuhof regards the family variety as an expression of atavism.
W. S. L.-B.

**Kienböck.** Ueber die Verletzungen im Bereiche der obersten Halswirbel und die Formen der Kopfverrenkung. Die typische Luxation des Kopfes im unteren Kopfgelenk (Luxation des Atlas) mit Abbruch des Epistrophenzahnes. [**Injuries to upper cervical vertebrae.**] *Fortschr. a. d. Geb. d. Röntgenstrahlen,* 1919, **26**, 95.

A paper extending to 55 pages, with numerous diagrams, an original case, and summary of previously recorded cases and full references. Unsuitable for abstraction but valuable to those interested in the subject of fractures and dislocations of the atlas and axis. X-ray details are given of some of the later cases. W. S. L.-B.

**Kaestle.** Zur vergleichenden Röntgenphysiologie der Magenbewegung. [**Radiological examination of gastric movements.**] *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1919, **26**, 181.

As the result of radiographs taken in rapid series upon the dog and upon man, K. concludes that the conception of an 'antrum pylori' and a 'sphincter pylori', put forward by Magnus and others, is incorrect. He insists that there is no evidence that the prepyloric portion of the stomach acts as a force and a suction pump, but shows by his radiograms that peristaltic waves arise at variable parts of the body of the stomach and pass gradually towards the pylorus. While the pylorus is closed this peristalsis brings about a mixture of the gastric contents. The radiological appearances of the stomach in man in the standing and in the lying positions are very different, and this may in part account for the confusion that has arisen. Addition of water (by drinking) does not essentially modify the appearances, and there is no evidence that Conheim was right in asserting that such fluid left the stomach, almost pure and without mixing with the other gastric contents, by way of a groove along the small curvature. W. S. L.-B.

**Assmann.** Hernia und Eventratio diaphragmatica. [**Diaphragmatic hernia and Eventration.**] *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1918, **26**, 1.

A. considers these two conditions from the radiological point of view, and shows that although a certain number of cases have been described in the past on clinical or on post-mortem grounds (e.g. Leichtenstern in 1874), radioscopy has revealed the fact that the two conditions are actually more common than was supposed. They differ from one another in respect of the existence or non-existence of an actual defect in any one of the leaves of the diaphragm. Consequently the radiological picture is determined by the absence of a diaphragmatic covering for the abdominal viscera in the case of hernia and its presence as a thin, stretched, but regular covering in the case of eventration. The non-existence or existence of the characteristic arched diaphragmatic shadow between the pulmonary field and the gas-filled stomach forms the means of diagnosis, but the different behaviour of the arched shadow-line during respiration does not constitute an infallible means of differentiation. Administration of contrast meals or distension of the stomach with gas, combined with radioscopy of the patient in different positions, give different pictures in the two cases, for in eventration one is able to separate the shadows given by the diaphragm and the stomach-wall respectively. Differentiation can also be made by means of determining variations in the intragastric air pressure during respiration, as was shown by Hildebrand and Hess (*München. med. Wchnschr.*, 1905, No. 16), for in eventration the stomach, being still an abdominal organ, shows both in inspiration and in expiration a preliminary diminution followed by an increase of intragastric pressure, whereas in hernia it shares in the thoracic conditions, so that the pressure falls during inspiration, rises during expiration. A case of each variety under the author's care is described fully and there is a full bibliography. W. S. L.-B.

## RADIOTHERAPY

**Mühlmann.** Ein Beitrag zum Kapitel der Röntgenschädigungen. [**Xerostoma after X-rays.**] *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1918, **26**, 43.

The occurrence of a moderate amount of early reaction, erythema, dryness of mouth, or hoarseness after irradiation even with hard rays in the region of the neck is well known to radiologists, though its explanation is still uncertain. In a large series of treatments of soldiers, M. met with one case of remarkable severity. The patient was a man under treatment for sycosis barbae and was treated twice at 23 days' interval. After the first irradiation there was a normal early reaction with xerostoma and slight hoarseness, all of which soon disappeared, as is usually the case. After the second irradiation there was again an early reaction which led to complete dryness of the mouth, the mucous membrane of the mouth being red and dull, the tongue dry and deeply cracked. Even mastication of bread led to no trace of saliva, and the bread looked as if it had been crumbled. Injection of pilocarpin led to a powerful secretion of saliva that lasted three hours but no longer. There was no hoarseness and the parotid regions appeared normal. The case was improved somewhat by inhalations and painting with boroglyceride and was lost sight of 8 months after the first treatment. A Müller boiling-tube was used with 3 mm. aluminium filter, distance of anode 24 cm., and a dose of 12·5 H. without overlapping of the fields.

W. S. L.-B.

**Fränkel, M.** Die X-strahlen im Kampfe gegen die Tuberculose, speziell der Lungen. [**X-rays in the treatment of tuberculosis.**] *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1918, **26**, 43.

A general survey of the X-ray treatment of tuberculosis, especially when affecting the lungs, largely from a theoretical point of view. The author argues for the importance of the spleen in immunity reactions from the rarity of carcinomatous metastases and of tuberculous foci in spleen even in widely generalized cases, and allies these facts with the observed results of irradiation upon the organ. He points out that large doses of rays cause a great diminution in size of the spleen and coincidently of numbers of lymphocytes, but that this change is a passing one, and recommends the administration of stimulative (small) doses in order to increase the number of lymphocytes. This same idea of an association of lymphocytes with immunity has been advanced by certain workers in this country and in America in reference to rat sarcoma and mouse carcinoma, and the administration of small stimulative doses has been recommended. That it is possible to increase the number of circulating lymphocytes by appropriate small doses of X-rays there is no doubt, but the exact relation of such a lymphocytosis to immunity against rat sarcoma is by no means certain, and probably the same is true in respect of tuberculosis. Similarly, F. recommends (1) irradiation of the ovarian region where tuberculosis is associated with anaemia on the grounds that haemopoiesis is associated with ovarian stimulation, and (2) irradiation of the thyroid upon the view that a relationship obtains between disordered thyroid activity and tuberculosis. The paper is rather in lecture form and stimulates thought. Many authorities are quoted in its length of 35 pages, but no references are given, which is a great disadvantage. It may well be, however, that the author's principle of treating the primary focus of disease with massive doses, and the spleen, ovary, or thyroid with small, stimulative doses, is sound, and that, as he says, the relation between X-rays and sunlight rays suggests that both should be utilized in the treatment of tuberculosis. W. S. L.-B.

**Mitscherlich.** Bestimmung der Ovarialdosis. [**Estimation of the ovarial dose.**] *Strahlentherapie*, 1917, **8**, 113. (Abstracted from *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1917, **25**, 168.)

The author refers in detail to the experiments carried out under Krönig in the Universitäts-Frauenklinik at Freiburg with the object of determining the 'ovarial dose', i.e. the smallest amount of X-radiation which is just sufficient to lead to amenorrhoea. As a measuring instrument he used a small ionizing chamber which was placed in the posterior fornix and was in connexion with a Szilard electrometer, i.e. a so-called iontoquantimeter. The source of rays was a Müller's water-cooled tube for deep therapy with 1 mm. copper filter and a focal distance from the skin of 40 cm. In place of the usual method of irradiating many fields, a single field of 14 × 14 cm. was subjected to the rays from before and behind in a single sitting of 4–5 hours. The two irradiations were so divided that the abdominal and sacral regions each received the same skin dose of about 50 X, though in the former region the iontoquantimeter received a much smaller dose than in the latter owing to the greater thickness of tissue through which the rays had to pass. Under the conditions stated erythema was never produced. From the experiments it was seen that administration of a total of 10 discharges of the electrometer was always sufficient to bring about amenorrhoea with certainty, so that this was the ovarial dose with the particular apparatus. In reference to this point it may be noted that the erythema dose of this same instrument of Friedrich and Krönig was found to be about 50 electrometer discharges, so that the ovary showed itself to be about five times as susceptible as the skin. Contrary to other observers the author found that the age of the patient had no influence upon the size of the ovarial dose, and the same was true with regard to the sequels of irradiations generally known as 'X-ray sickness'. W. S. L.-B.

## RADIUM THERAPY

**Contdamin and Nogier.** La radiumthérapie en gynécologie. [**Radium therapy in gynaecology.**] *Marseille médicale*, 1918, **3**, 97. (Abstracted from *Arch. d'electric. méd.*, 1918, 191.)

As explanation for publishing the cases summarized below, the authors point out that 'the results asserted by those who have applied radium therapeutically in inoperable cancer are sometimes so extraordinary and so inexplicable in our present state of knowledge that they often provoke a scepticism which can only disappear after the publication of numerous facts'. Six cases are described. Case I was that of an abdominal tumour, reaching two fingers' breadth above the umbilicus in a girl aged 12 years. Exploratory laparotomy showed that radical intervention was impossible owing to adhesions of and fixation deep in the pelvis. A month later

126 mgm. Ra was inserted for 48 hours into the centre of the tumour. For a month the patient's condition was grave, but gradually the tumour disappeared entirely and she returned to a perfect state of health. In this case there was no histological examination. A general toxaemia was noted after insertion of the radium which causes the authors to advocate as complete a removal of tumour tissue as possible with the knife before applying the radium. Cases II, III, IV, and V were carcinomata of the cervix uteri of varying degrees of severity, II and III being inoperable, IV a case of vaginal hysterectomy with subsequent radium treatment, and V a case of recurrence after Wertheim's operation of abdominal hysterectomy. Cases II and V were completely well three years after radium treatment; cases III and IV were still quite well, but the interval since treatment was not as great. In all these cases 126 mgm. Ra were applied for 48 hours. Case VI was one of large fibroids which diminished to a quarter of their original size; the patient had long been an invalid and for the past four years had been enabled to take up ordinary life again as the result of the radium treatment. The excellent results are probably dependent upon the large quantities of radium employed. W. S. L.-B.

## RADIOTECHNIQUE

**Mazérès.** Sur la mensuration de l'aire cardiaque. Application de la méthode des quadratures de Tchebitchef. [**Mensuration of the cardiac area.**] *Arch. d'electric. méd. et de phys.*, 1919, **29**, 72.

Three methods of determining the cardiac area in orthodiagrams are in general use: (1) weighing the cardboard on which it is delineated: this requires that the cardboard should be of constant thickness and homogeneous and that the tracing should be cut out of the entire sheet, so that the method is very rough; (2) estimation of the area by superposing squared transparent paper: the evaluation of the marginal portions where entire squares are not concerned may introduce serious error; (3) use of Amsler's polar planimeter: a rapid and accurate method but one needing a special apparatus. To these M. adds Tchebitchef's method of integrating plane surfaces for any curve which is very practical and exact. The orthodiagram having been prepared, the extreme points to right and left are marked and a line is drawn between them ($AB$). To right and left of the mid-point of this line ($O$) three lines ($L_1$, $L_2$, &c.) are drawn on each side at right angles to $AB$ and at distances 85/100, 4/10, and 3/10 of $AO$. Then, Tchebitchef has shown that the area $S = \frac{AO}{3}(L_1 + L_2 + L_3 + L_4 + L_5 + L_6)$ and since $AO = \frac{AB}{2}$, if $N =$ the sum of the lengths $L_1$, $L_2$, &c., the area in square millimetres of the cardiac area may be obtained by the formula $S = \frac{AB}{6} \times N$.

W. S. L.-B.

**Russ, S.** **A suggestion for a new X-ray unit in radio-therapy.** *Arch. Radiol. & Electroth.*, 1918, **23**, 226.

It is suggested by R. that the lethal action of radium rays on cells of malignant new growths should be utilized as the basis of estimating the amount of irradiation used clinically or for experimental purposes in biology. He found that exposure of rat sarcoma cells to the beta and gamma radiation from a source of radium bromide having an intensity of 2·75 mgm. per sq. cm. prevented those cells from growing in another rat after inoculation. This quantity he suggests should be called a 'Rad'. Other experiments have shown that mouse carcinoma cells and spheroidal cells of a human breast carcinoma were 'killed' by quantities of the same order of magnitude. By ionization and photographic measurements he determined the corresponding amount of X-radiation, and found that after exposing the rat sarcoma cells to that dose a similar absence of growth after inoculation was brought about. 'Hard' X-rays and 'soft' X-rays, beta rays and gamma rays, were found to be equally effective, due allowance being made in order that the quantity of radiation absorbed should be the same. By allowing a measured portion of the beam of X-rays to which the patient is being exposed to fall upon one portion of a photographic plate, another portion of which has been previously exposed to the action of a known source of radium, and developing the entire plate, the value of the X-ray dose can be determined in terms of radium bromide and therefore of the lethal dose for the malignant cells. 'Let us assume, for the purposes of an example, that the X-ray tint for an exposure of ten seconds was equal to that obtained with an exposure of six seconds with the radium. The radium capsule, when applied to malignant cells, causes complete inhibition of their proliferation after an exposure thereto for one hour; this latter quantity is the suggested unit, viz. the Rad. Hence, we may say that the dose of X-rays at the position occupied by the plate during the ten seconds' exposure would be $\frac{1}{600}$ Rad. Suppose now that during a séance the tumour cells had been exposed for twenty minutes to the above intensity of X-rays, the dose received would be $\frac{20 \times 60}{10} \times \frac{1}{600} = \frac{1}{5}$ Rad.' Practical difficulties are stated in the paper, and it is suggested that some competent body such as the National Physical Laboratory might prepare the radium-exposed photographic plates (undeveloped), on which the X-ray exposures would be made by the clinical radiotherapist at a subsequent date as required by him. [Since so large a portion of radiological work is concerned with treatment of malignant new growths, there is a manifest advantage in knowing what ratio the dose administered bears to the dose which has been found experimentally to be lethal for malignant cells. Clearly the suggested unit is not accurate in the same sense as that suggested by Bordier, which depends upon the amount of iodine liberated from a solution of iodoform in chloroform under irradiation, but it may well be that the Rad has a real practical value in biological, and especially in medical, radiology.] W. S. L.-B.

**Bucky.** Über gas-freie Röntgenröhren. [**Gas-free Röntgen tubes.**] *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1918, **25**, 453.

In the tubes of Coolidge and Lilienfeld, the quantity of residual gas is so small that the ionization produced by collision is negligible, and both depend on the electrons given off by hot wolfram wire to carry the discharge. The original pattern of the Lilienfeld tube is described. Three sources of e. m. f. are necessary for its action. The first serves to heat a small coil of wolfram wire, called the 'glow-cathode', which is surrounded by a metal cylinder. This cylinder and the glow-cathode are connected through the second source of e. m. f., the strength of which is about 100 volts. The former is also connected with an anticathode of the usual shape, and a high potential difference is applied between these and an ordinary cathode. The action of the tube is not quite clear, but Lilienfeld adopts the following view. The electrons from the hot wire carry a current between this and the surrounding metal cylinder; this is called the 'primary current'. It is assumed that, in this way, positively electrified particles, the nature of which is unknown, are set free, and these, under the influence of the force between the cylinder and the ordinary cathode, bombard the latter, thus producing the cathode stream, which impinging on the anticathode gives rise to Röntgen rays. The greater the 'primary current', the greater the conductivity of the tube; and, with a given 'primary current', an increase in the strength of the third e. m. f. will increase the velocity of the excited rays. Thus the intensity and hardness of the resulting Röntgen rays can be varied independently.

The construction of the apparatus has been considerably modified, but the principle remains the same. The 'glow-cathode' is now situated behind the cathode, which is a thick metal cylinder with a hole bored along its axis, and the anticathode is at the other end of a long tube. The cathode takes the place of the metal cylinder, and the positive particles, which are produced by the electrons from the hot wire striking its rear surface, liberate new electrons which pass through the hole in the axis. A small cylindrical cathode stream is thus obtained. The electrical connexions are altered so that only two primary sources of e. m. f. are needed, namely, that for heating the wire and that for the high-tension current.

The Coolidge tube is much simpler both in construction and in theory. In this case the hot wire electrons constitute the cathode stream.

The two forms of gas-free tube have each their advantages. In the Lilienfeld tube, as the cathode stream is cylindrical, all the electrons strike the anticathode, whereas the hot wire in the Coolidge tube emits electrons in all directions, and, though most strike the cathode, some may hit the tube in other places and give rise to Röntgen rays of a different type. For this reason also the rays from the Lilienfeld tube come from a small circle on the anticathode, and a sharper image is obtained of any object placed in their path than is the case when rays proceed from all parts of the anticathode. Moreover, in the Lilienfeld tube the intensity of the rays is directly proportional to the current passing through the tube. and this serves as a measure of the dosage administered in radiotherapy. Owing to the electrons from the Coolidge hot wire being emitted in all directions, those that do reach the anticathode have varying velocities, and so the resulting radiation is not so homogeneous as that from the Lilienfeld tube. On the other hand, the Lilienfeld tube is heavy, its shape is inconvenient, and it has to be water-cooled. The high-tension resistance through which the anticathode and the cathode are connected in the modified form is cumbrous and a source of trouble. The first cost of this tube is higher than that of the Coolidge.

This paper was read before the Berlin Röntgen Society, and in the discussion which followed results comparing different makes of tube were given. Von Deehend-Hamburg stated that he had compared the hardness of the rays which could be obtained from a Lilienfeld tube, a Coolidge tube, and a tube of the residual-gas type. The limit of hardness was the same in all cases, being attained at about 140,000 volts. It was such that the ionizing power was reduced to half by a filter of 11 mm. of aluminium or 3·9 cm. of water. He further ascertained the thickness of the filters necessary to produce homogeneity. They were as follows: Lilienfeld with high-tension resistance, 8–9 mm. Al; Lilienfeld, original pattern, 6 mm. Al; old type of tube, 10–11 mm. Al; Coolidge tube, 15–16 mm. Al. J. Schütze stated that the intensity of the rays from a gas-free tube does not increase after the current has reached 20 milliamps. but rather decreases. Herr v. Buol contraverted the statement that the radiation from the Coolidge tube is less homogeneous than that from the others. He showed that an error of ± 1·5 per cent. in measuring the radiation after it had traversed the filter would entail an error of 3 mm. Al in the 'homogeneity point'. Spectrographs have been taken of the radiation from a Coolidge tube with a voltage of 70,000 after passing through aluminium filters ranging in thickness up to 15 mm., and from the diagrammatic representation of these it can be seen that a 5 mm. screen renders the beam practically homogeneous, even though the voltage is lower than that usually employed in therapeutic work.

J. R. C.

## ELECTRO-DIAGNOSIS

**Bordier, H.** La R. D. partielle apparente, peut exister sans lésion nerveuse. [**False reaction of degeneration.**] *Arch. d'clectric. méd.*, 1919, **27**, 38.

In 1915 B. accidentally found partial R.D. in the interossei of the hand and the muscles of the hypothenar eminence in a patient with contracture of the hand and flaccidity of the muscles, but found no evidence of a nerve lesion. Later, he observed similar phenomena in other cases of a 'functional' kind, but could not offer an explanation until he re-examined some of the patients in whom the phenomenon had occurred previously; on this later occasion the muscular reactions were normal. He then observed that the partial R.D. which had been obtained in winter was absent in summer and associated it with extreme coldness of the hands of the patients. Experiments carried out on healthy persons whose hands had been immersed for a quarter of an hour in ice-cold water afforded him corresponding electrical reactions, though somewhat less marked. Warming the hands of the 'functional' patients in whom the partial R.D. had been observed sufficed to remove the abnormality. As a corollary he advises that hypothermia of muscular masses must be combated in all cases in which it exists, from cases of functional contractures and paralyses to cases of anterior poliomyelitis, and recommends that this should be carried out by means of diathermy. W. S. L.-B.

# MEDICAL SCIENCE

## ABSTRACTS & REVIEWS

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# REVIEWS

## CEREBRO-SPINAL FEVER

THE epidemiology, clinical picture, and treatment of cerebro-spinal fever are exhaustively discussed by Rolleston in his three Lumleian lectures, to each of which a bibliography is appended. After a brief historical sketch, in which he states that the first undoubted account of the disease is of an outbreak in and around Geneva in the winter of 1805, by Vieusseux, he shows how the disease has increased during the war, the cause being mainly the crowding together of young recruits in camps and barracks under conditions which on the one hand lead to an increase in the carrier rate, and, on the other, reduce the resistance of the individual. The incidence of the disease in the army in this country was as follows: from September 19 to December 31, 1914, 50 cases with a mortality of 31, or 60 per cent.; during 1915, 1,195 cases with 586 deaths, or 49 per cent.; during 1916, 967 cases with 430 deaths, or 44·6 per cent.; and during 1917, 1,337 cases with 593 deaths, or 44·3 per cent. The annual ratio of cases of cerebro-spinal fever per 1,000 admissions was 63 in 1915, and 31 in 1916. Out of a total of 420,000 officers and men belonging to the Canadian Expeditionary Force from 1914 to 1918 there were 367 cases with a mortality of 198, or 54 per cent. The incidence among the New Zealand Expeditionary Force from July 1917 to September 1918 was 75 cases with 24 deaths, or 32 per cent., among a strength ranging from 14,000 to 21,000. Among the Australian Force in the United Kingdom there were, in 1916, 65 cases with 29 deaths, or 44·6 per cent.: in 1917, out of an average strength of 64,431 officers and men, 104 cases with 36 deaths, or 34·6 per cent.; and in 1918, out of an average strength of 56,186, 23 cases with 12 deaths, or 52 per cent. In the United States Forces in France the rate per 10,000 ranged from 0 in June 1917, to 37·1 in November of the same year. As regards the seasonal incidence the vast majority of cases occur during the first six months of the year, but Rolleston did not find that meteorological conditions exerted a definite influence on the incidence of the disease in connexion with 93 cases occurring at large naval depôts during the first three months of 1915. Carter and Boyes, in their analysis of 100 cases of epidemic meningitis, also state that no seasonal or meteorological condition can be shown to have influenced the incidence or death-rate, save that the larger number of cases occurred in the three winter months of December, January, and February. The greater frequency of cerebro-spinal fever after influenza is attributed by Rolleston to impaired resistance and the presence of a chronic carrier with an influenza cough.

In a study of an epidemic of meningococcus meningitis in a Chinese civil population Olitsky found that the factor of greatest importance in the dissemination of the disease was extensive overcrowding. The grounds for this conclusion were: (1) Meteorological conditions. (2) The relative incidence of the disease in crowded and uncrowded sections. (3) The bacteriological evidence obtained from patients. (4) The relation of the carrier.

(1) The importance of meteorological conditions was shown by the fact that cold weather, especially in the absence of sunshine, resulted in an increase in the number of cases. (2) The disease took its greatest toll from the crowded districts. Among the Chinese it was common, while among the foreign element only an occasional case developed. On the other hand, in a neighbouring city where the Chinese were four times as numerous, but not so densely settled, not a single case occurred among the natives. (3) The bacteriological evidence obtained from the patients was suggestive of the spread of the disease by close contact. 95 per cent. were infected with one type, the parameningococcus. As other types were found in the community it was reasonable to assume that the rapid communicability was the result of the great density of the population. (4) The relation of the carrier was studied in the inmates of a jail. Although 24·6 per cent. of the 130 inmates were carriers of various types of meningococci, not a single case developed at the institution, in which there were isolated cells and no overcrowding. Moreover, among contacts Europeans showed 9·8 per cent., while Chinese showed 6·7 per cent. of carriers. Yet the Chinese far outnumbered the European cases. The other factors contributing to the continuance of the epidemic were probably the constant migration and unhygienic habits of the natives.

In his remarks on the epidemiology, prevention, and clinical features of cerebro-spinal fever, based on his experience at a large X garrison, Dorgan emphasizes the following points: (1) The prevalence of atypical and unrecognized forms of the disease. (2) The prime importance of these atypical forms in the spread of the disease. (3) The absence of any evidence at X garrison to show that carriers convey active infection. The statistics as to carriers are regarded by Dorgan as conflicting and inconclusive, and the isolation of carriers as impracticable, irrational, and unjustifiable. (4) The infection in cerebro-spinal fever is not to be found under good conditions of housing and ventilation. The early isolation of mild and severe cases, and provision of free ventilation compulsorily, and with sufficient warmth during the time of seasonal prevalence, constitute the most effectual means of prevention.

In a postscript Dorgan quotes the views of Galambos and other German writers, which were abstracted in the *Medical Supplement*, 1918, **1**, 214 *b*, as they fully confirm his contentions.

Stévenin found that the relative frequency of **meningococcus carriers** in epidemic and non-epidemic foci was as follows: among 652 persons examined who had been living in the same rooms as meningitis cases 77, or 11 per cent., were carriers. Among 2,844 men examined who belonged to the barracks or cantonment where the case had occurred, but had not been living in the same room as the patient, 355, or 12 per cent., were carriers. Of 333 men in a non-contaminated environment, i.e. living in barracks or cantonments where no cases of cerebro-spinal meningitis had occurred, and at periods when there were none in the district, 26 persons, or 7 per cent., were found to be carriers. None of these carriers, whom Stevenin was able to keep under observation for months, transmitted the disease. These results resemble those obtained in England by Eastwood and Griffiths (*L. G. B. Rep.* 1915–16), who found 9·0 per cent. of carriers among 480 patients at St. Bartholomew's Hospital, where there was no case of meningitis, and still more those of Lewis (*ibid.* 1917), who found that 8 per cent. of 401 persons examined at Birmingham were carriers. The results are quite different from those obtained in another disease transmitted by carriers, namely, diphtheria, in which the specific bacillus is only found exceptionally apart from foci of diphtheria.

Rolleston divides the **chronic forms** of cerebro-spinal fever into (1) cases which are not treated or if treated do not receive the appropriate serum, so that the meningococcic infection continues unaffected. (2) Cases with meningococcic septicaemia which may precede, follow, or occur without meningeal infection. (3) Cases with meningitic adhesions and obstruction to the free circulation of cerebro-spinal fluid, so that parts of the cerebro-spinal arachnoid space become shut off and form closed cavities inaccessible to serum injected intrathecally. Gordon records ten fatal cases of this last form of chronic meningitis, eight of which came to autopsy, at which diffuse pachymeningitis, dilatation of the lateral ventricles, and meningeal adhesions in isolated areas, especially at the level of the cervical and lumbar segments, were found. With two exceptions, aged 7 and 13 years respectively, all the patients were adults. The longest case lasted 13 months and the shortest two and a half months. Clinically the cases were characterized by the alternation of remissions and aggravation of the disease, and the development of nutritional changes accompanied by motor, sensory, and trophic disturbance.

Colard reports four cases of **meningococcic septicaemia**, two of which belonged to the pseudo-malarial type with intermittent fever first described by Netter (vide *Medical Supplement*, 1918, **1**, 11 *b*, 94 *b*), and two to the erythematous type. In such cases the diagnosis may be difficult, especially if there is enlargement of the spleen, but the possibility of malaria is soon excluded by the constant absence of haematozoa, the leucocyte formula, and the complete inefficacy of quinine treatment. Moreover, enlargement of the spleen often does not occur, and in any case is moderate in degree in spite of the duration and intensity of the affection.

In two cases, reported by Faroy and May, of meningococcic septicaemia without meningitis, and accompanied by suppurative arthritis, the septicaemic stage simulated typhoid or paratyphoid. The characteristics of the arthritis were the thick appearance and grass-green colour of the fluid withdrawn from the joint and the slight degree or even complete absence of pain (*vide infra*).

Another case of meningococcal septicaemia assuming the form of intermittent fever is recorded by Lemierre and Lantuéjoul. The course of the disease was complicated by bilateral parotitis, followed by orchitis and thyroiditis. During the febrile attacks successive crops of erythematous and purpuric rashes appeared, and were accompanied by severe pain in the lower limbs, which was followed by muscular atrophy. No meningeal symptoms were observed. On lumbar puncture the cerebro-spinal fluid was under hypertension, but was clear and sterile. The patient's serum, however, agglutinated the meningococcus A in a dilution of 1 in 50, and the result of treatment confirmed the serological test. Considerable improvement followed subcutaneous injection of a polyvalent antimeningococcal serum, and a cure was rapidly effected by the use of antimeningococcus serum A.

To emphasize the **extra-meningeal rôle of the meningococcus** Herrick reports the following six cases in which meningitis was absent or a subordinate part of the disease. (1) Meningococcus sepsis without meningitis either clinically or at autopsy. (2) Meningococcus sepsis without clinical meningitis but showing *post mortem* meningeal congestion and arachnoid hyperplasia—the earliest stages of meningitis. (3) Meningococcus sepsis without meningitis, septic polyarthritis, and recovery under intravenous treatment. (4) Meningitis tarda or meningitis with a premeningitic stage of meningococcus septicaemia of several weeks' duration. (5) Meningococcus pleurisy, and (6) Meningococcus empyema of the accessory nasal sinuses, both without meningitis. Herrick recommends that the term epidemic cerebro-spinal meningitis should be abandoned. The term meningococcus infection should be used to denote such general processes as meningococcus sepsis. Meningococcus meningitis should be the term used in the case of meningococcus infection with predominant cerebro-spinal symptoms.

Stone and Brown record a fatal case of cerebro-spinal fever in a man aged 24, complicated by endocarditis and pericarditis. At the necropsy a vegetation was found on the inner surface of one cusp of the aortic valve, and at the base of the outer surface there was a small deep ulcer, smears from which showed many meningococci.

Three fatal cases in which acute meningococcic vegetations were found *post mortem* on the aortic and mitral valves are also reported by Krumbhaar and Cloud.

Sainton describes three forms of meningococcal arthritis: (i) associated with cerebro-spinal meningitis; (ii) associated with septicaemia apart from meningitis; (iii) occurring apart from other infection.

(i) The frequency of arthritis in the course of meningitis varies from 5·5 per cent. according to Netter and Durand, to 20 per cent. in Sainton's cases. The arthritis may precede, accompany, or follow the meningeal symptoms. The following types are described: (1) an arthralgic type characterized by fleeting articular pain without swelling. It often precedes the suppurative forms. (2) Acute suppurative type, occurring in two-thirds of the cases. Its course is usually mild; it may end in rapid and complete absorption. (3) The subacute suppurative type, which is rare. (4) Haemarthrosis, the only instance of which was recorded by Virchow. (5) A plastic type with early ankylosis, which is equally rare.

(ii) Meningococcic rheumatism. In the acute form the patients usually have a rigor, and a rise of temperature very often accompanied by herpes. The articular localizations are at least as mobile as in articular rheumatism, but the functional disturbance is comparatively insignificant and the pain is less acute. It rarely occurs alone, but is nearly always associated with other phenomena, such as erythema, broncho-pneumonia, orchi-epididymitis, or suppurative irido-choroiditis.

(iii) Primary arthritis. Sainton has seen three cases of arthritis as the sole manifestation of a meningococcic infection, meningococci being found in the greenish pus obtained on puncture of the joint. Cure is usually spontaneous, but is remarkably assisted by injection of 10 c.c. of anti-meningococcic serum into the joint after removal of the fluid.

In an article on the renal localizations of meningococcic infection Sabrazès records an illustrative case in a soldier, aged 20, and comes to the following conclusions: The meningococcus may give rise to suppurative pyelitis, in the pus of which it is found in great abundance. The pyuria is accompanied by a large amount of albumin and epithelial casts. The stage of pyuria does not last long, the pus and meningococci disappearing from the urine in about four weeks. The nephritis, on the other hand, lasts for months, giving rise to a nitrogenous retention which may persist for about a year after the onset; the albuminuria at the end of this time is very slight, but the presence of red cells and hyaline casts still indicates a certain degree of renal involvement. Unlike other forms of pyelonephritis, which are usually abrupt in their onset, persistent and refractory to treatment, meningococcic pyelitis, like most of the purulent complications of meningococcic infection, is insidious in its onset, lasts only a short time, and is easily curable, although the nephritis persists. Pyelitis is one of the rarest extra-meningeal complications of the meningococcus.

Latham states that epididymitis has been an unusually frequent complication of cerebro-spinal meningitis during the epidemics of the past year at Camp Jackson. In one series of 290 cases of cerebro-spinal meningitis it occurred in more than 3 per cent., and during a sporadic outbreak in October 1918 it was much more frequent. There was no relation between the occurrence of the complication and the severity of the meningococcus infection. The cause of the infection was doubtful: it was not due to venereal disease. There was very little pain or other symptoms connected with it. As a rule the globus major only was attacked, usually on one side only, and there was no associated orchitis. There was a comparatively quick return to normal and an absence of any atrophy.

A case of complete sensory and motor paralysis of the fifth cranial nerve on the right side is reported by Testut and Marchand, the patient presenting anaesthesia of the skin of the face, lips, gums, teeth, palate, nasal fossa, eyeball, and dorsum of the tongue on the right: loss of taste in the anterior two-thirds of lingual mucosa on the same side: atrophy of the right temporal and masseter muscles, and vaso-motor changes in the right half of the face. There was an oblique oval deformity of the buccal orifice when the mouth was opened, owing to paralysis of the mylohyoid. The patient also suffered from attacks of pain which were not confined to the territory of the fifth nerve, but spread to the back of the neck and occipital region. The attacks could be reproduced by pressure on the skin of the face, and also occurred independently. This symptom has recently been described by Nonbrun and Atanassio-Benisty as part of the 'sympathetic syndrome', and by Mairet and Piéron under the name of 'trigemino-occipital irritation'.

**Glycosuria** is a rare occurrence in cerebro-spinal meningitis. Loeper and Gouraud found it in 1 out of 7 cases, Cazamian in 9 out of 113, and de Massary and Tockmann in 3 out of 45 cases. In all these three cases, which were fatal, the lesions were predominant in the cerebral ventricles, which explains the inefficacy of the serum given by intraspinal injection. Claude Bernard showed that certain lesions limited to the floor of the fourth ventricle caused the appearance of glycosuria, and others have shown that puncture of the third ventricle, especially of the region of the infundibulum, has the same consequences. The predominance of the lesions in the ventricles thus explains the occurrence of glycosuria in the three cases. Conversely, glycosuria should be regarded as a symptom of inflammation of the ventricles, and its presence in a case of meningitis should suggest the predominance of ventricular lesions. In spite of the favourable statistics of Cazamian, only one of whose nine cases died, the writers regard meningitis accompanied by glycosuria as a grave form of the disease, in which, in addition to lumbar puncture, trephining should be performed.

Nelli records the results of treatment of 100 cases (67 soldiers and 33 civilians) at the isolation hospital of Tombetta, Verona. In 1916, 24 patients were treated by lumbar puncture only, with 7 deaths, a mortality of 29·17 per cent. In 1917, 48 patients were treated by intraspinal injections of antimeningococcic serum, with 11 deaths, a mortality of 22·92 per cent. In 1918, 29 patients were admitted, 16 of whom were treated by lumbar puncture only, with 4 deaths, and 13 by lumbar puncture followed by serum, with 4 deaths. Serum treatment after the fifth day of disease was almost always unsuccessful. The doses for the first injection were 40–50 c.c. in adults, and 10–20 c.c. in children. In very severe cases 70–80 c.c. were given. The mild and moderate cases had three injections, one every other day, and the other cases were injected for three days in succession, and the injections were continued until the principal symptoms disappeared.

Olitsky's observations, which were made at a local hospital where none but Chinese were received, were based on a total of 417 patients. 114 received neither serum treatment nor lumbar puncture, and of these 84·6 per cent. died, the mortality corresponding with the general death-rate from the disease throughout Southern China. In 346 patients lumbar puncture was made from one to five times, and of these 54·1 per cent. died. In 71 patients lumbar puncture was combined with the intraspinal injection of antimeningococcic serum having a low antibody content, and of these 45 per cent. died.

Experience in the Royal Navy bears witness to the beneficial influence of serum (Rolleston): among 96 cases not treated by serum 49, or 51 per cent., proved fatal, and out of 105 cases treated in 1915 with serums which appeared to be inert 64, or 61 per cent., were fatal; whereas out of 295 cases treated with serum during the second, third, and fourth years of war the mortality was 95, or 32·7 per cent.; 176 of these cases receiving Flexner's serum alone, with a mortality of 51, or 29 per cent.

Bigelow records a series of 18 cases of non-epidemic meningococcal meningitis in which, in spite of serum treatment, the mortality was 63⅔ per cent. Most of the patients received two and some even four kinds of polyvalent serum, an average of 278 c.c. intraspinally and 191 c.c. intravenously being given to each case. With the exception of two cases which were extremely insidious in onset, all the patients received their first injection from the first to the fifth day after the onset of symptoms. All the fatal cases but one came to autopsy, but none showed any appreciable ventricular dilatation or other evidence of obstruction which would help to account for the poor results.

Stone and Truitt emphasize the importance of early energetic treatment in which both intravenous and intraspinal therapy should be included, especially in cases with petechiae. The following plan is recommended: first day, one intravenous injection of from 60–80 c.c. of serum and two intraspinal injections of from 30–40 c.c. each, after removal of from 45–55 c.c. of cerebro-spinal fluid, according to its pressure; second day, 80–100 c.c. intravenously and two spinal injections; third and fourth days repeat; fifth to eighth day, one spinal injection; ninth and tenth days, one spinal drainage daily. The writers always found it wise to desensitize before giving the first intravenous injection by a subcutaneous injection of

1 c.c. of serum. If anaphylactic symptoms occurred the injection was stopped and the attempt repeated later. Epinephrin chloride, 1 c.c. of the 1 in 1,000 solution hypodermically, relieved the symptoms of anaphylaxis. Atropine, gr. $\frac{1}{100}$ hypodermically, was also useful.

Landry and Hamley also recommend the combination of intraspinal and intravenous injection of antimeningococcal serum, their practice being to give 60 c.c. of serum intravenously diluted with an equal quantity of 0·6 per cent. saline one to one and a half hours after the intraspinal injection. The value of intravenous injection was shown by the results in the following three groups of cases: (1) Of 83 cases treated without serum intravenously 45 died, a mortality of 54·2 per cent. (2) Of 9 cases treated with serum intravenously late in the disease 5 died, a mortality of 55·5 per cent. (3) Of 34 cases treated intravenously on admission 11 died, a mortality of 32·3 per cent. In the cases of blocking, i.e. closing up by the exudate of the communication between the cerebral and arachnoid spaces at the base of the brain, direct introduction of serum into the lateral ventricles and under the dura was carried out in five cases with one recovery.

Stetten and Roberts report the case of a man aged 19 who during an attack of cerebro-spinal meningitis suddenly developed signs and symptoms of acute obstructive hydrocephalus. A rapid cure followed puncture of the corpus callosum and draining the ventricle without injection of serum. As the fluid withdrawn from the ventricle was only slightly turbid and sterile the writers attributed the condition to ventricular obstruction only, but recommend that when there appears to be an actual infection of the ventricles as shown by the fluid being turbid or frankly purulent or by the presence of diplococci in the smear, intraventricular administration of the serum should be combined with puncture of the corpus callosum.

Camac and Bowman recommend that all patients admitted with marked toxic symptoms and all who are doing badly should be given intravenous injections of serum, in doses of 50 or 60 c.c., once every 24 hours. Very commonly a chill followed by a rise of temperature to 103°, 104°, or even 105° occurs, but this is often followed by a drop to normal or subnormal and should cause no alarm.

In obstinate cases Colard recommends the association of vaccine treatment with serotherapy, the intravenous route being used as recommended by Nolf. He is in favour of the dose being gradually increased, instead of giving a large dose at the first. If no general reaction occurred after an initial dose consisting of 1 c.c. of an autogenous vaccine containing 50,000 micro-organisms per c.c., the dose was increased to 100,000, 200,000, and so on.

Rolleston points out that the fever and constitutional disturbance preceding or accompanying the other manifestations of serum disease may be attended by a recrudescence of meningeal symptoms, and a relapse is then suggested. This rare manifestation of serum disease, which is sometimes called **seric meningism** or **seric meningitis**, is peculiar to intrathecal injection of serum. It has been attributed by Netter and Debré to serotoxic oedema of the meninges, and is analogous to the swelling of the mucous membranes originally attacked by diphtheria at the time of the serum reaction. The symptoms, which are probably due to some hypersensitiveness of the meninges, can be distinguished from a true recrudescence of meningococcal meningitis by examination of the cerebro-spinal fluid for meningococci and the presence of sugar. If the cerebro-spinal fluid is clear, contains sugar, and is free from meningococci, there is no recrudescence of infection, and fresh intrathecal injection of serum may be followed by very severe pain, delirium, or other signs of meningitis.

Embleton and Steven employed the following methods of treatment of meningococcus carriers at the Carrier Centre at Netley: inhalation chamber in which chloramine-T or zinc sulphate vapour was inhaled for seven minutes; hand sprays of chloramine-T, acriflavine 1 per 1000, electrosal, and lecithin 0·1, 0·5, 1·0 per cent. in liquid paraffin; direct application of tinct. ferri perchlor., iron alum, acid carbolic; and the use of an ointment containing ung. hydrarg. nit. dil. It appeared doubtful if any local treatment materially interfered with the meningococci when once they had invaded the deeper tissues. In 35 out of 36 cases, or in 97 per cent., the type of meningococcus was found to be the same in the naso-pharynx as was found in the cerebro-spinal fluid, and with one exception cases during convalescence carried only one type throughout. The average duration as carriers of 86 cases was just under six months from the onset. Forty-nine cases carried less than this time and 37 exceeded it. The longest time that a case was proved to carry was 608 days.

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J. D. R.

## INFLUENZA

**Cardio-vascular system.** In an article on the 'influenza heart' Eichhorst states that he has only rarely found anatomical changes in the heart in his influenza patients. Up to January 1919, he has treated 2,411 cases at the Zurich University Medical Clinique with 351 deaths, a mortality of 14·6 per cent. All the fatal cases showed pneumonia which was almost always bilateral and only affected the lower lobes. Only eight cases, or 0·3 per cent., presented anatomical changes in the heart, viz. sero-fibrinous pericarditis in two cases, and endocarditis of the mitral valve in six cases, two of which came to autopsy. No changes were found in the myocardium either by naked eye or microscopical examination. The principal way in which influenza affects the heart is by producing a functional disturbance which causes more discomfort than actual danger to life. Eichhorst describes four varieties of the 'influenza heart' which are characterized by tachycardia, bradycardia, extrasystoles, and cardiac neuralgia respectively. The first variety is the rarest, Eichhorst having seen only four examples of it, two in hospital, and two in private patients. The tachycardia, which may be the first and for a long time the only sign of an influenzal infection, may occur in the acute stage or first develop in convalescence. The bradycardiac variety is the most frequent, and may also be found either at the height of the disease or in convalescence. Unlike the tachycardiac form, it is often of long duration, many cases being seen in which it has lasted more than six months after the attack of influenza. Extrasystoles may occur both in the tachycardiac and bradycardiac varieties, but the extrasystolic variety properly so called is one in which the extrasystoles are associated with a normal frequency of the heart. This third variety is more frequent than the tachycardiac, but decidedly less common than the bradycardiac, and, like the latter, may persist for more than six months. The variety characterized by cardiac neuralgia is comparatively rare. It was met with in men only, between the ages of 25 and 32, and its occurrence is probably favoured by indulgence in alcohol and tobacco.

Grassmann draws attention to the relative bradycardia and low blood-pressure which are both very pronounced in influenzal pneumonia. Thus with a temperature of 104° the pulse may be 80, without any administration of digitalis, and in many cases the pulse frequency may be unaffected for days by the high temperature. In young vigorous men the blood-pressure as measured by the Riva-Rocci instrument may drop to 90 mm. or 80 mm. Hg, remaining low throughout the febrile stage, and even longer still, but usually rises as the temperature falls. The fall of blood-pressure is of therapeutical importance, as it occurs early, when the general condition still appears satisfactory.

Czyhlarz and Neustadtl record four cases with cardiac complications. One was a fatal case of left-sided empyema and fibrino-purulent pericarditis, and of the other three which were still under treatment two had pericarditis and endocarditis, and one endocarditis only. In only one of the cases had there been a history of previous heart disease. In two cases the cardiac complication was a late development, occurring during resolution of pneumonia.

In an article on influenzal phlebitis in 1918–19, Lereboullet and Hutinel state that it is a mild complication indicating a very attenuated form of septicaemia, probably due to secondary infection. Its insidious onset may sometimes give rise to errors of diagnosis, and the condition may be mistaken for neuralgia or neuritis. It is frequently bilateral. It is not accompanied by embolic or trophic complications, and apart from immobilization does not require any special treatment, recovery usually taking place without any sequelae.

**Respiratory system.** Du Castel and Dufour report two cases of influenzal broncho-pneumonia in soldiers accompanied by a subnormal temperature. As Prosper Merklen has shown, a subnormal temperature is remarkably frequent in soldiers, especially in prisoners of war, who are specially liable to fatigue and depression. The intense asthenia and low blood-pressure in such cases suggest the possibility of suprarenal insufficiency.

**Alimentary system.** In an article entitled ‘Teething and Influenza’, Langstein, who is in charge of the Kaiserin Augusta Viktoria Institution for prevention of infantile mortality, states that in none of the many hundreds of cases of teething which he has seen has he observed any symptoms which could be attributed to it, such as convulsions, eruptions, restlessness, or digestive disturbances. On the other hand, he has been impressed by the frequency of febrile disturbance at this period, but in every case of this kind he has been able to prove that the fever was not due to teething but to an influenzal process.

In accounts of the recent influenza epidemic, jaundice has been mentioned as a serious and often terminal symptom. In Crawford's experience, however, jaundice though a fairly common complication is not of serious import; it has sometimes occurred as a relapse after the patient has recovered from the initial attack. Bronson reports a number of cases of catarrhal jaundice associated with influenza in children, and classifies them in the following groups: (1) those in which jaundice followed exposure to influenza, but which did not develop influenza in the ordinary sense; (2) those which developed jaundice as a sequel to an attack of influenza; (3) doubtful cases in which there was no known exposure to influenza.

Paschkis records two cases of inflammation of the caecum in the course of influenza, the haemorrhagic character of which was shown by the autopsy on one of the cases which revealed haemorrhagic necrotic colitis and appendicitis, sero-haemorrhagic infiltration of the retroperitoneal connexion tissue, and haemorrhagic infarction of the local lymph glands. The cases are of practical interest inasmuch as in influenzal patients with abdominal symptoms the possibility of haemorrhagic typhlitis should be considered. They are also of theoretical interest in illustrating the relatively rare intestinal localization of influenza, and the tendency of all influenzal inflammation to be haemorrhagic.

**Ear and throat.** Farner, assistant at the Zurich Otorhinolaryngological Clinique, states that the tendency to aural complications varies considerably in different epidemics. In the winter of 1889–90 and in the following years, influenzal otitis was very frequent. In the 1918 epidemic, on the other hand, it was decidedly less common. From the beginning of July to the end of December 1918, only 85 ear cases due to influenza visited the Clinique, and in another hospital at Zurich only 30 ear cases occurred among 861 influenza patients. Of the 115 cases, 71 were males and 44 females, 90 were between the ages of 16 and 35, 12 were younger, and 13 older. In 49 the otitis was of the acute catarrhal variety (in 40 unilateral, in 9 bilateral), and in 56 suppurative (in 47 unilateral, and in 9 bilateral). The otitis began on the first day of disease in 23 cases, on the second day in 7, and the third to seventh day in 45, in the second week in 24, in the third week in 4, and in 12 the date of onset could not be determined. Haemorrhagic vesicles on the tympanic membrane with sanguineo-purulent secretion in the tympanic cavity was seen in 31 cases. In 13 paracentesis was performed. Mastoid irritation was observed in 17 cases, and mastoid abscess in 12, in one case on both sides.

The following organisms were found in the pus: pneumococcus in 5, *Streptococcus pyogenes* in 3, *Streptococcus mucosus*, diplostreptococcus, pneumococcus and diplostreptococcus in one each; in 1 the pus was sterile.

The course of influenzal otitis, apart from the cases complicated by mastoid abscess, was rapid and favourable, and purely nervous symptoms such as neuralgia and 'nervous' deafness were much less frequent and pronounced than was formerly the case.

Blackwell reports five cases of perisinus mastoid abscess subsequent to influenza in young adults, and comments on the comparatively small number of serious cases of mastoid suppuration which have hitherto accompanied influenza in view of the wide prevalence of the epidemic, its virulent character, and the proximity of the chief site of infection to the mastoid cells.

Two forms of influenzal laryngitis are described by Herzog: (1) a mild circumscribed form which is sometimes the only manifestation of influenza. As a rule the symptoms subside when the patient is confined to bed with applications of ice to the neck and forbidden to speak, but it is always possible for this mild form to be converted into (2) diffuse phlegmonous laryngitis, which is characterized by increasing dyspnoea and cyanosis. Herzog records three cases of this form in adults, two of whom were tracheotomized with one death, and the third recovered after endolaryngeal incisions.

In a paper based on his experience at the Zurich University Children's Hospital, Coray states that involvement of the larynx was one of the peculiar features of the disease as seen in children. He describes the following three groups:

(1) Pure influenzal croup or laryngotracheitis. Of 10 cases of this kind 8 recovered without operation, 1 was intubated, and 1 was intubated and tracheotomized. All recovered.

(2) Influenzal croup with pneumonia. Of 6 cases, 5 died and 1 recovered. Intubation was performed on two cases, and intubation and tracheotomy on a third.

(3) Influenza with laryngeal diphtheria as a secondary infection. Two cases, on which intubation was performed, were fatal.

Comparing the influenza epidemic of 1889–90 with that of 1918–19 from the standpoint of the throat specialist, Réthi points out that in both epidemics the cases showed redness and necrosis of the epithelium of the fauces, submucous laryngitis, and tracheitis without ulcer formation, as well as perichondritis of the larynx, with abscess formation, and palatal and laryngeal palsies.

Influenza, like other infectious diseases, especially enteric fever, scarlatina, diphtheria, and pneumonia, is occasionally followed by perichondritis of the larynx, which is liable to occur both in mild and severe cases. The perichondritis assumes the form either of an acute suppurative inflammation which not infrequently leads to necrosis or runs a more chronic course with infiltration of the cartilage and sequestrum formation. The aetiology of post-influenzal perichondritis is not yet definitely established. In most cases there seems to be a mixed infection with streptococci. According to Marchand perichondritis after influenza, like that following enteric fever, originates in ulcers in the larynx. In four cases of post-influenzal perichondritis reported by Brüggemann no ulcers were found in the larynx, but merely a catarrhal condition of the laryngeal mucous membrane which often appeared very slight. The perichondritis, however, may have originated therefrom, or it may have been of haematogenous origin, especially as laryngeal perichondritis due to this cause has been found in other infectious diseases. The diagnosis is usually easy. It may, however, be difficult when the affected cartilage cannot be clearly seen, as in disease of the cricoid. The prognosis should be reserved. Rapid recovery frequently occurs, but the condition may become exceedingly chronic in spite of operation.

**Psychoses.** In an epidemic reported by Fell among soldiers who were mostly between the ages of 20 and 30, only four out of 2,500 cases developed psychoses of a severe type which outlasted the acute disease. Twenty cases of post-influenzal psychoses under the same writer's observation were classified in three groups: (1) manic-depressive group, 8 cases; (2) infective psychosis group, 7 cases; (3) dementia praecox group, 5 cases. Predisposition as shown by family or personal history was only pronounced in the manic-depressive group. The occurrence of dementia praecox symptoms was not a sure indication of permanency, but such cases ran a longer course and recovery was less likely.

**Skin.** Galewsky states that since the middle of December 1918 he has been consulted daily by his lady patients for their loss of hair. The occurrence was all the more striking as young women and girls were almost exclusively affected while older women escaped. Although he had seen a large number of influenza cases in men, he had only met with three cases among them in which loss of hair occurred. In almost all cases there was a characteristic history of a high fever lasting for days, and most of them had had complications of various kinds, such as pleurisy, pneumonia, or septic tonsillitis. In a few cases, however, the fever had been of quite short duration. The alopecia usually set in five to eight weeks after the end of the attack of influenza. Numerous patients complained of an abnormal sensitiveness of the scalp, especially in the occipital region and sides of the head, though it was not possible to mark off any definite nerve areas. The patients also suffered from nervous depression, and were tormented by the fear that they would lose all their hair, and that it would be many months before it would grow again. Zurhelle, of the Bonn University Skin Clinique, who had also had considerable experience of post-influenzal alopecia, states that on microscopical examination the hairs show a thinning and transparent condition at or about 40 mm. from the end of the root. The average growth of the hair being, as Pinkus has shown, 0·4 mm. daily, a year will elapse before the hair becomes 18 cm. long, and it will be five to six years before the longest hairs are replaced. Apart from this the prognosis is favourable.

The predilection of post-influenzal alopecia for the female sex is shown by the fact that all but three were females among 24 cases reported by Ayres, who offers the following possible explanations for this occurrence. (1) Males may be less susceptible to post-influenzal alopecia. (2) Post-influenzal alopecia may be less noticeable among men owing to the greater incidence of premature alopecia among them. (3) Women and girls may be more anxious about the condition of their hair, whereas men and boys do not trouble to come to hospital for such a condition. In all but one of Ayres's 24 hospital cases the alopecia was of the diffuse type; in one hospital case, and another in private practice, there were definite areas of alopecia.

Merian draws attention to analogous changes in the nails consisting of superficial or deep grooves running across the nail. In almost all cases they appear in all the finger nails, but sometimes they are seen on the thumb nails only. In a few cases both the finger and toe nails are simultaneously affected. Similar changes have been observed after pneumonia, pulmonary tuberculosis, erysipelas, scarlet fever, measles, and rheumatism, and are known as Beau's lines. If the rate of growth of the nail be reckoned as 0·1 mm. per diem, and the covered part of the nail as 3–4 mm., the groove will first be seen after 30 to 40 days. As the growth of the visible part of the nail takes about five to six months, the onset of the disease can be calculated. The presence of these grooves also possesses some forensic significance.

Pinkus remarks that Beau's lines and alopecia, though often associated, do not necessarily correspond, complete absence of hair being sometimes accompanied by only slight changes in the nails.

According to Galewsky the treatment of post-influenzal alopecia should differ according as the head is dry or greasy. Seborrhoea should be treated by stimulating lotions, electrotherapy, and the quartz lamp. In the case of a dry scalp a lotion containing grease should be substituted or used alternately with a pomade.

Ayres recommends the promotion of a healthy circulation in the scalp, which can be most easily attained by massage with the head lowered, by avoidance of obstruction to the main vessels supplying the scalp, by padding the hat-band at appropriate points, by stimulating lotions, and by keeping the scalp clean. The use of the ultraviolet rays from the mercury vapour lamp is advocated by Levin.

A fatal case of **gas gangrene** of the thigh in influenza complicated by pneumonia is reported by Nigst. The patient, a woman aged 40, had been injected intramuscularly in the thigh with camphor, and during her delirium probably contaminated the site of the puncture with her faeces. A fulminating gangrene from which Fraenkel's gas bacillus was cultivated set in, and death took place in a few hours.

Nothnagel records a case of bilateral **mastitis** in influenza in a woman aged 46 which subsided without suppuration. The condition was probably a metastatic phenomenon like the orchitis, mastitis, and oophoritis of mumps. Nothnagel was unable to find any mention of this complication in the literature of the 1889–90 epidemic, and only two cases in the literature of the present pandemic, one being an instance of unilateral mastitis in a girl mentioned by Guleke, and the other one of bilateral mastitis reported by Ide (vide *Medical Supplement*, 1919, **2**, 74 *b*).

Numerous papers continue to appear dealing with the effect of influenza on **pregnancy**, **labour**, and the **puerperium** (vide *Medical Science*, 1919, **1**, 48). In a series of 50 patients reported by Titus and Jamison, in whom pregnancy was complicated by influenza, miscarriage or premature labour occurred in 21 or approximately 42 per cent. Seventeen of these died, and only four recovered, a mortality of 80·9 per cent. Of the 29 women whose pregnancy was undisturbed, 14 or 42·2 per cent. died, whereas the remaining 51·8 per cent. recovered without any apparent effect upon their pregnancy. The writers regard the mechanism by which the disease disturbs pregnancy as a combination of factors such as deoxygenation of the blood, excessive accumulation of $CO_2$ in the blood, and a degree of toxaemia sufficient to cause the death of the foetus. The ill-effect of abortion or labour is attributed to the following causes:

(1) Muscular exertion increasing the already excessive amount of $CO_2$ in the blood, and further straining the already weakened myocardium.

(2) Sudden release of intra-abdominal pressure by the extrusion of the foetus in an advanced pregnancy.

(3) Sudden reduction of blood-pressure by haemorrhage incident to labour.

(4) Lessened resistance to the ordinary shock of labour and delivery.

Bland has collected records from various hospitals and practitioners in Philadelphia of 337 cases of influenza in pregnancy with a total mortality of 46 per cent. The returns show that practically all mild cases recover, and the pregnancy continues. In moderately severe uncomplicated cases the majority of mothers get well, and only a very small minority succumb:

occasionally the pregnancy is interrupted. In severe complicated infections a high mortality is the rule. At least 69 per cent. of the women die, and abortion or premature labour occurs in more than 50 per cent. The prognosis is extremely grave for the babies, among whom the mortality is about 50 per cent. In a series of 21 cases of influenza complicating late pregnancy and labour reported by Welz, there was a maternal mortality of 57 per cent. and a foetal mortality of 66⅔ per cent. The foetal mortality is lessened when the mother recovers, and it is therefore inadvisable to try to save the child by means detrimental to the mother.

Kosmak, who reports 21 cases of influenzal pneumonia in pregnancy with 15 deaths, does not hold the view that pregnant women are more liable to contract influenza than the non-pregnant, but maintains that young adults of both sexes are equally prone to the severer types of infection. His advice is to treat the influenza and let the pregnancy take care of itself. When pneumonia occurs as a complicating factor, he does not resort to induction of abortion or labour unless some other circumstances call for it.

Fraenkel states that 300 autopsies on influenzal cases were performed at the Pathological Institute of Frankfort University between June 1918 and the end of February 1919. 181 were on men and 119 on women. The unfavourable influence of pregnancy on the course of the disease was shown by the fact that 34, or more than a third, of the 93 women between the ages of 15 and 50 were pregnant, or had just been delivered or aborted. Other figures illustrating the high rate of mortality from influenzal pneumonia in pregnancy and the puerperium will be found in the articles of Ottow, Benthin, and Seitz.

**Prophylaxis.** According to Silvestri the systematic prophylactic use of quinine for a period varying from 8 to 20 days does not have an immunizing effect in the strict sense of the term, at least when given in doses of 15–18 grains a day. Prophylaxis of this kind, however, often appears to attenuate the form of influenza, though the same effect is produced in scarlet fever and measles as well. Not only malaria but any infectious disease in an active condition may produce immunity to influenza, though the immunity ceases when the disease is cured or in periods when there has not been an attack of malaria for a long time.

Unlike many other writers (vide *Medical Supplement*, 1919, **2,** 168*a*) Castellani has found that influenza not only does not spare malarial patients but that it assumes in them a specially severe course, especially in cases of relapsing malaria with wasting, anaemia, and enlargement of the spleen, the broncho-pneumonic form of influenza being particularly severe. In October and November 1918 hundreds of malarial patients were admitted to a hospital at Durazzo under Castellani's care. Some had been sent in with the diagnosis of malaria, and on examination were found to have influenzal broncho-pneumonia, and others supposed to have influenza were really suffering from malaria. But whether they were malarial subjects or not, all had been receiving large doses of quinine, thus showing that this drug does not convey immunity to influenza.

**Treatment.** Tincture of digitalis in large doses was given by Lyon, Tenney, and Szerlip as a routine practice at the beginning of influenzal pneumonia. The usual single dose was a drachm or a drachm and a half repeated three times a day until from five to six doses had been given within a period of from 30 to 36 hours. The patients received therefore from 300 to

500 minims of the tincture, representing one-tenth strength of the crude drug. As a result of this large dosage the writers saw very few cases of bradycardia below 60 a minute. Having used these large doses in about 2,000 cases of pneumonia of different types in the course of six months they feel justified in asserting that these doses are not dangerous or likely to produce serious disturbance of the heart. On the other hand, the treatment proved of distinct benefit, the pulse remaining slow and regular to the end even in fatal cases.

In an article on the treatment of influenzal pneumonia Hildebrandt states that when an extension of the pneumonic process or heart failure is the cause of dyspnoea and cyanosis, free bleeding is indicated to prevent paralysis of the right heart. At a single sitting he has removed 17 to 28 oz. and in two as much as 35 oz. Of course the general condition and degree of plethora must be taken into consideration, and for that reason bleeding has had to be given up in several cases. Treatment of influenzal pneumonia by intravenous injections of 0·45 to 0·6 gm. neosalvarsan recommended by some writers (vide *Medical Supplement*, 1919, **2**, 169 *a*) or subcutaneous injection of diphtheria antitoxin (*ibid.*) proved quite ineffectual.

An example of non-specific protein therapy of influenzal pneumonia is given by Cowie and Beaven, who treated nine cases by intravenous injection of dead typhoid bacilli. Their conclusions were as follows: (1) It is a safe procedure within limitations. (2) It is indicated only at the beginning stage of pneumonia. (3) It is contra-indicated in (*a*) cases of influenzal pneumonia beyond the third day of disease, or (*b*) when there is undoubted evidence of advanced myocardial insufficiency or acute endocarditis. (4) No more than 500 million dead typhoid bacilli should be given at one injection, and at least 48 hours should intervene before the next injection. (5) The immediate effect of the foreign protein is the development of a typical protein paroxysm, which is followed by a marked decrease in the temperature and a definite improvement in the subjective symptoms, both of which are usually permanent. (6) The injection of the typhoid protein is followed by a characteristic leucocyte movement. The leucocyte increase in the cases studied was only of moderate degree, and there was no permanent improvement in the leucopenia. (7) The effect on the pulse, respiration, physical signs, and urine are practically negligible. (8) An intravenous injection of typhoid protein may bring about a termination of the acute symptoms of the disease in from one to three days.

Wells also treated 11 cases of influenzal pneumonia by intravenous injections of foreign protein consisting of dead typhoid bacilli. With two exceptions the patients were critically ill and presented a grave prognosis. From 30 to 45 minutes after the injections they experienced a typical protein reaction characterized by a severe chill, and moderate cyanosis lasting from 15 to 20 minutes and followed by profuse sweating and marked rise of temperature. Shortly after the period of sweating the patients felt much better. In several cases a rapid crisis followed the rise of temperature and complete recovery took place. Eight of the 11 cases showed an increase in the total number of leucocytes after the injections, but in only five cases was the increase well marked. Wells concludes that though the intravenous injection of foreign protein is efficacious in selected cases it should not be employed as a routine by the general practitioner.

Patschkowski has treated 40 cases of influenzal pneumonia with injections of milk, 10 c.c. of boiled milk being injected into the muscles of the thigh. The question as to whether repeated injections are required has not yet been decided, but Patschkowski regards them as desirable. Eight of the cases died, but all of them were in a state of great cardiac weakness on admission. The violent reaction observed after injections of milk for articular rheumatism was seldom observed in these cases. The temperature often fell to normal a few hours after injection and remained so, or rose again for a short time two or three days later. There was a striking improvement in the general condition, and no harmful results were observed.

The importance of early vaccine treatment in influenzal pneumonia is emphasized by Wynn, who used a polyvalent triple vaccine containing equal numbers of pneumococci, streptococci, and influenza bacilli in doses ranging from 80 to 100 millions of each organism for an adult man, 60 to 80 millions for an adult woman, 40 to 50 millions for a child of 12 to 14, and 10 to 20 millions for a child of two or three years. While 71·4 per cent. of those injected on the first day had a normal temperature within 24 hours, on the second day the percentage was 47·8, on the third day 50, on the fourth day 30, and on the fifth day 35·7. Of the ten deaths which occurred among the 107 cases, seven were not inoculated till the fourth or fifth day.

Roberts and Carey treated 86 cases of influenzal pneumonia by expectant treatment with 27 deaths, or a mortality of 31·2 per cent., and 200 cases by vaccine with 19 deaths, or a mortality of 9·5 per cent. Each c.c. of the vaccine contained 100 million influenza bacilli, 100 million pneumococci Types I, II, and III, 100 million streptococci, and 100 million staphylococci. At first 0·5 c.c. was used as an initial dose, which was doubled daily until four doses had been given. Later 1 c.c. was used as an initial dose, and the subsequent doses were regulated by the amount of reaction. In the cases treated by vaccine the temperature fell to normal by crisis in 36 per cent. and the others in 20 per cent.

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J. D. R.

## DIPHTHERIA

Blanton and Burhans report on the incidence of diphtheria at Camp Custer, Michigan, from September 1917 to March 1919, during which time out of 113,000 soldiers only 57 developed the disease. Most cases ran an extremely mild course. Only two cases of paralysis and one of myocarditis resulted. One death was due to streptococcic septicaemia after the diphtheria had clinically subsided. Six cases showed albuminuria and three casts in the urine. Of 8,236 apparently healthy throats from which cultures were taken, 1·8 per cent. were found to be carriers of diphtheria bacilli. Tonsillectomy was the final and only satisfactory method for dealing with chronic carriers. Of 7,851 Schick tests done, 10·3 per cent. were positive, which is about the recognized average incidence among naturally unprotected persons between 21 and 31 years of age.

**Wound diphtheria.** Weinert states that since his previous paper on this subject (vide *Medical Supplement*, 1919, **2**, 126 *a*), the number of cases of wound diphtheria in Magdeburg and its immediate neighbourhood has risen to over 200, the clinical diagnosis being confirmed by bacteriological examination. More than half the cases showed a condition of progressive ulceration, and 10 per cent. had both faucial and wound diphtheria. Several factors were responsible for the prevalence of wound diphtheria, such as the overcrowding of the hospital, the want of clean linen, and vermin (lice, fleas, scabies, &c.). In several instances diphtheria was spread by eating and drinking vessels, food, playing cards, or paper money. In many persons the bacilli were present not only in the throat, but also on the hands, especially under the finger-nails. The ulcers were often the result of scratching, their condition and extent being produced by the matter inoculated (staphylococci, diphtheria bacilli, &c.), by lice, and the scabies parasites. There were two principal forms of wound diphtheria seen at Magdeburg, which have also been described by other writers, namely, (1) a croupous or superficial form, (2) a diphtheritic or deep form, between which all sorts of transitional forms were seen. At the beginning of the epidemic the croupous forms were more frequent. Relapses occurred in a number of cases, in some of which the wound had completely healed. Small vesicles formed upon the dark blue-red scar and these became converted into small or even extensive characteristic ulcers containing diphtheria bacilli, which were rapidly cured by application of tincture of iodine. As regards the clinical condition of patients with wound diphtheria only a relatively small number appeared to be severely ill. Many showed no special change in their general condition, and others only complained of a burning sensation in their wounds. The temperature was usually not high unless complications were present, such as abscess formation, lymphangitis, or coexistent faucial diphtheria. The favourable condition of the patients with wound diphtheria was probably due to the relatively slight absorption of toxins, and it was usually found that the severe cases had faucial diphtheria as well.

Treatment consisted in injecting antitoxin subcutaneously or intramuscularly or applying it locally as a dressing. In some instances antitoxin however given had no effect. Excellent results were obtained from painting the wounds with a strong solution of iodine. Recently Weinert has reserved antitoxin for severe cases, or for mild ones when they proved obstinate or in which faucial diphtheria developed. In a postscript he adds that a number of cases had developed paralysis of accommodation and palatal palsy, although most of them had had no throat symptoms. The result of treatment with dry antitoxin had been very good, especially in severe cases with a tendency to gangrene. In a women's clinique at Magdeburg wound diphtheria had developed on a perineal tear, and two infants, of whom one died, and several adults contracted faucial diphtheria.

Owing to the outbreak of wound diphtheria in the various military hospitals at Magdeburg 497 wounds were examined bacteriologically under Nieter's supervision with the result that 286, or 58·6 per cent., were positive. In some cases diphtheria bacilli were present in almost pure culture, and in others they were more or less scanty. In the great majority staphylococci or less frequently streptococci or both were also found. The nature of the bacilli was established by the presence of the Babes-Ernst granules and cultural tests, and in eight cases by inoculation of guinea-pigs. In some instances the patients' throats were also examined with negative results in most cases.

Weinert's article induced Schmid to allude to several cases in his own practice of wounds which showed no tendency to heal until cultures had revealed the presence of diphtheria bacilli and antitoxin had been given. As a rule Schmid found that wound diphtheria caused a less acute illness than faucial diphtheria, but had an equally prejudicial effect on the general condition and on the heart.

Anschütz and Kisskalt of the Kiel University Surgical Clinique emphasize the importance of a knowledge of wound diphtheria both in general practice and still more so in hospital work. Every kind of wound may be infected, but the writers found that wound diphtheria was particularly frequent in influenzal empyema. The appearance of the infected wound varies considerably. It may be covered by a grey or yellowish grey more or less adherent membrane, and in some cases be accompanied by an infiltration of the surrounding tissues (phlegmonous form), or on the other hand present the ordinary appearance of a wound without any deposit or special reddening of the edges. There is sometimes an undermining of the edges of the wound (ulcerative form). The diagnosis can only be made as a rule by bacteriological examination, but occasionally a retrospective diagnosis can be made by the occurrence of characteristic palsies (paralysis of accommodation and deglutition and peripheral palsies) which the writers have seen after wound diphtheria without any faucial involvement.

Donges and Elfeldt of the Rostock University Surgical Clinique investigated 100 cases of various wounds for the presence of diphtheria bacilli, and in 19 cases found organisms resembling them morphologically and in cultures. The bacilli were never found in pure culture but always in association with other bacteria. In five cases the diphtheria bacillus and *Bacillus pyocyaneus* were found in the same wound. Animal experiments were carried out in six cases, in only two of which the organisms proved pathogenic to guinea-pigs. Although all forms of wounds were cultivated, the bacilli were found to be remarkably frequent in cavities or at least in wounds of the soft parts and bones. 20 per cent. of the positive cases were severe local infections. The bacteriological results showed that apart from animal experiment only a limited prognostic significance could be attached to the presence of diphtheria bacilli in wounds. In only two patients were toxic symptoms observed.

Hock of the Wurzburg University Surgical Clinique examined 38 cases in which the wounds presented any appearances suggestive of diphtheria, such as fibrinous deposit, membrane formation, or delay in healing. In five cases, or 13·7 per cent., the result was positive. In none of the cases was there a history of a previous attack of diphtheria or sore throat in the patient or his entourage. It was a remarkable fact that in all the positive cases post-influenzal empyema played a definite part. Hock suggests that the influenzal infection so lowers the resistance of the patient that diphtheria bacilli like other virulent organisms find a favourable soil in the pleural exudate. In some instances the wounds presented a typically diphtheritic appearance although bacteriological examination showed an absence of Klebs-Loeffler bacilli. On the other hand, these organisms were found in two cases in quite ordinary wounds. Zülig's dictum that there is no clinical criterium of the appearance of wound diphtheria was thus fully confirmed. Hock also agrees with Jacobsohn and Wieting that diphtheria bacilli are met with more frequently in wounds than before, but in most cases in a non-virulent form. With one exception, in which death was due to multiple lesions (diphtheritic infection of an empyema wound and faucial diphtheria), all the cases recovered without special treatment.

Jacobsohn records an example of wound diphtheria in which, unlike most cases on record, the infection of the wound was primary and was not followed until 24 hours later by faucial diphtheria. Palatal palsy subsequently developed. The bacilli disappeared from the throat in 24 hours' time, but were still found in the wound 17 days later.

Hartsell and Morris report on 60 cases of wound diphtheria in soldiers, most of which occurred in a ward where there were several cases of faucial diphtheria and carriers. In none of the wounds were there any systemic symptoms referable to diphtheria toxin. Most of the patients were well in every way, and none showed any rise of temperature other than might be explained by a large open wound. The clinical appearances of the wound varied. 12 per cent. showed a greyish membrane quite typical of diphtheria. About one-half showed only a faint greyish discolouration of the granulating surfaces which would have passed unnoticed under ordinary conditions. About 6 per cent. looked absolutely healthy and ready for secondary closure. The presence of diphtheria bacilli in the wound had apparently no effect. Wounds that were slow in healing invariably had large numbers of other organisms present. Wounds that appeared clean progressed in the ordinary way. Forty-three patients were subjected to the Schick test, and six were positive, which is about the ordinary percentage for all adults. The most efficient application was tincture of iodine, under which treatment the average duration of the positive cultures was six days. Diphtheria antitoxin was used in four cases up to four doses of 20,000 units each, but had no effect in ridding the wound of the bacilli. Owing to the dearth of laboratory animals it was impossible to test the organisms for virulence, and the diagnosis of diphtheritic infection of wounds was based purely on cultural methods with study of the morphological characteristics and to some extent the biological.

**Diphtheria and influenza.** In an article on the simultaneous occurrence of influenza and diphtheria in the obstetrical department of Kiel University, Karlbaum shows that the prognosis of diphtheria among newborn children is decidedly aggravated when associated with influenza. An endemic of nasal diphtheria among the newborn, which according to general experience is relatively harmless, on combination with influenza was accompanied by a mortality of 50 per cent. The gravity of the association of diphtheria and influenza is also shown by Klotz, who states that of 97 cases of diphtheria admitted to the children's hospital at Lubeck, 24 developed cardiac complications and 13 died. The unusually high incidence of cardiac complications was attributed to the fact that the children had had an attack of influenza from two weeks to four months previously which had created a *locus minoris resistentiae* in the heart. On the other hand, Constable records seven cases in children who developed diphtheria in convalescence from influenza. All recovered and no note is made as to the occurrence of any complications.

Coray points out that the laryngo-tracheitis of influenza predisposes to diphtheria, and records two fatal cases of post-influenzal diphtheria in children who died of asphyxia in spite of intubation. The necropsy in one case showed a continuous cast of the trachea and bronchial tree, and in the other a diffuse laryngo-tracheitis with shreddy deposit.

**Diphtheritic paralysis.** Walshe examined a large number of cases of post-diphtheritic paralysis following faucial, cutaneous, and wound diphtheria, and came to the following conclusions: (1) Palatal paralysis does not occur except after faucial diphtheria. (2) The musculature of the palate and the region of the infective focus derive their innervation from the same source, the glosso-pharyngeal-vagus-accessorius nuclear system and its peripheral fibres, and are thus closely related anatomically. (3) In extra-faucial diphtheria the paralysis often shows (27 per cent.) an onset anatomically related to the infective focus. (4) Polyneuritis follows both faucial and extra-faucial diphtheria equally, and, irrespective of the site of the infective focus, presents a remarkably constant symptom-complex. (5) Paralysis of accommodation follows both forms of infection though the faucial more frequently than the extra-faucial. It is therefore not a 'local paralysis', and its more constant association with faucial infections may be explained by the close proximity of the local central nervous lesion to the oculo-motor nuclei. (6) The palatal paralysis constitutes the 'local', the ocular affection the 'specific', and the polyneuritis the 'generalized' forms of diphtheritic paralysis. In extra-faucial diphtheria, as in tetanus, the local paralysis varies with the site of the infective focus. (7) It seems highly probable that the local paralysis is due to an 'ascending lymphogenous toxi-infection' (by the perineural lymphatics) of the central nervous system from the infective focus. The essential pathological lesion here is central and not peripheral. (8) The ocular and generalized symptoms are probably the result of the circulation of the toxin in the bloodstream, whence it gains access to the whole nervous system, central and peripheral.

In 1916 Gerson described two cases of myasthenic bulbar paralysis in which he found diphtheria bacilli in the nose, and regarded them as the cause of the condition. He subsequently examined a large number of patients suffering from nervous irritation and paralysis the cause of which was unknown and the symptoms were not characteristic of any definite disease, and found that some of them were diphtheria bacillus carriers. In each case the bacilli were in the nose and not in the throat. He now records nine cases, in most of which there had been no history of diphtheria but the patients had been treated for years as neurasthenics, and had been repeatedly sent to aural and ophthalmic surgeons without obtaining any relief. Most of them complained of becoming rapidly tired on walking or on muscular effort of any kind. All possible treatment had been tried without having any lasting effect. Two of the patients who were soldiers were regarded as simulators. On careful examination it was found that in some there were slight sensory changes, and that one or more reflexes were lost, in others there were changes of muscular excitability, and in the most marked cases there were myasthenia, paresis, and flaccid paralysis with all transitions up to the most complicated form of polyneuritis and combined systemic disease. Aggravation of the condition was caused by injection of antitoxin, but improvement and ultimate recovery followed removal of the bacilli by local treatment.

**The Schick test.** Johnson carried out the Schick test for diphtheria susceptibility in 500 cases with the following results: (1) Cases which have never had diphtheria or antitoxin give a positive reaction in a large percentage (86 per cent. in the first year, declining to 26 per cent. between 12 and 21). (2) Cases which have had the disease, or have had immunizing doses of antitoxin three or more years previously, very frequently show a reaction (in 50 per cent. between 8 and 12, and in 44 per cent. between 12 and 21). (3) Cases which have had diphtheria or antitoxin within two weeks of the test show a reaction in a comparatively small number of cases. (4) Individuals who are exposed to diphtheria, such as doctors and nurses, give a positive reaction in 12 per cent.

De Elizalde applied the Schick test to 673 children in an asylum, and to 221 in a children's hospital, and classified the results by ages, commenting on the negative reaction in very young infants as evidently due to the infants sharing the mother's immunity. This transmitted immunity is gradually lost, so that by the age of three the maximum reaction is obtained. After three natural immunity is acquired, so that only 5–15 per cent. of adults give a positive reaction. The reliability of the test is confirmed by the fact that in the whooping-cough ward 15 of the children gave a positive reaction and 23 gave no response. Diphtheria was introduced into the ward, but only five of the children contracted it, and they all belonged to the positive group.

**Treatment of diphtheria by ordinary horse serum.** In the course of four years Bingel treated 471 cases of diphtheria in patients of all ages with antitoxin, and 466 with ordinary horse serum, without observing any differences in the results. In some instances, indeed, the results obtained with ordinary horse serum were better. Thus in uncomplicated cases the throat became cleaner more quickly, and the bacilli disappeared sooner from the throat, so that the duration of treatment was shorter. Moreover, in cases treated with ordinary serum, toxaemia, myocarditis, and nephritis were less frequent, and paralysis was less severe. These differences, however, were so small that they might be regarded as a mere coincidence, but they were sufficient to show that no superiority could be attributed to diphtheria antitoxin. Bingel concluded that the success of serum therapy in diphtheria could not be attributed to the antitoxin content of the serum, and suggested that the large doses used at present and at the beginning of the antitoxin era were responsible for the good results obtained. Bingel's paper naturally gave rise to a storm of protest, and numerous articles appeared tending to invalidate his conclusions both from the clinical and experimental standpoint.

The most important clinical refutation comes from Feer, who treated 65 cases of diphtheria in the Zurich University Children's Cliniquè with antitoxin, and 57 with ordinary serum, intramuscular injections being given in all cases, and in a few intravenous ones as well. Patients treated with antitoxin were given an average of 4,000 units, or 12–15 c.c., and those treated with ordinary serum, 13 c.c. Only the mild cases were given ordinary serum; all the severe cases, with one exception in which ordinary serum was injected by mistake with a fatal result, received antitoxin. Although the cases treated with ordinary serum had not been ill for so long, the average time for the throat to become clean after injection was 5–7 days, or 2–4 days longer than those treated by antitoxin. In six cases it was necessary to inject diphtheria antitoxin subsequently.

The fresh appearance of membrane in the throat from three to nine days after injection of ordinary serum was frequently observed. Palatal palsy occurred in four of the ordinary serum cases and in only two of the antitoxin cases, although most of the cases treated with ordinary serum were much milder than those treated with antitoxin. These results were so unequivocally in favour of antitoxin that the experiment was not continued. It was obvious that the action of diphtheria antitoxin was due to the antitoxin content, and that the serum in itself had only a slight effect. Feer suggests that Bingel's results may have been due to his having used serum from horses which hafl formerly supplied antitoxin, or that mistakes had occurred in giving antitoxin when ordinary serum was intended.

Karger, assistant at Czerny's Children's Clinique at Berlin, reports the case of a child, aged six years, suffering from abdominal tuberculosis, who was given seven intramuscular injections of ordinary horse serum, each dose consisting of 10 c.c., but nevertheless developed nasal diphtheria. Rapid recovery followed injection of 1,500 units of antitoxin. Karger points out that the development of diphtheria after a prophylactic dose of 70 c.c. of antitoxin has never occurred, whereas an equal amount of ordinary horse serum was unable to prevent this taking place. The rapid recovery after a comparatively small dose of antitoxin supplies further evidence of the superiority of antitoxin over ordinary horse serum.

Joannovics condemns Bingel's practice on the following grounds: (1) It deprives the patient of a remedy, the value of which has been confirmed for over 20 years, without substituting a better one. (2) The question cannot be decided on purely clinical grounds, but requires animal experiment, which was carried out long ago. (3) The result of the relatively small number of observations without taking various factors into account is completely worthless statistically. (4) The value of the early use of antitoxin in diphtheria has actually been confirmed by Bingel's figures, as the mortality among his cases treated with antitoxin on the first day of disease was 9·09 per cent. as compared with 13·63 per cent. among the ordinary serum cases.

Confirmation of the prophylactic and curative value of diphtheria antitoxin and of the inefficacy of ordinary horse serum in the experimental diphtheria of guinea-pigs, mice, and rabbits will be found in the recent articles by Friedberger and Kolle and Schlossberger.

Lévy and de Léobardy examined the blood of nine diphtheria bacillus carriers, and found that in four the serum did not possess any immunizing power, and in five presented a more or less active antitoxic action. Of the five cases, one had a slight tonsillitis and three others an erythema of the pharynx, so that four of the five cases had a definite or larval form of diphtheria. Two similar cases had been recorded by Lévy in 1914 in his Paris thesis. The writers conclude that the blood of some diphtheria bacillus carriers possesses an immunizing power which is almost always best developed in cases where the organism has shown a more or less definite reaction to the bacillus.

Zingher furnishes statistics to prove (1) that the morbidity and mortality from diphtheria are still quite high and constant, showing that (*a*) in spite of the extensive use of small prophylactic doses of antitoxin the total number of cases of diphtheria has not been reduced to any extent; (*b*) the isolation and treatment of diphtheria carriers are of little benefit in accomplishing results on a large scale. (2) That children from one to five years are most susceptible to the disease and show by far the highest mortality. (3) That the mortality from diphtheria is nearly as great as that of measles and scarlet fever combined. (4) That the yearly mortality from diphtheria in the United States is 23,540, and the morbidity is approximately 10 times higher. Zingher maintains that all infants below 12, and if possible below 18 months of age, should be actively immunized with three doses, each consisting of 1 c.c. of toxin-antitoxin, irrespective of the Schick test they may show at the time of immunization. The injections are given subcutaneously and repeated every seven days. All infants over 18 months of age, as well as all infants and adults, should be tested with the Schick reaction first, and only those giving a positive reaction immunized with toxin-antitoxin.

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## TUBERCULOSIS

In an article on the forms of disease observed at Lille during the occupation of the town by the Germans Lemoine states that tuberculosis assumed a frequency and an acute course hitherto unknown to him. In 1916 almost fulminating cases occurred which proved fatal in a few weeks. All treatment was unavailing. The chemists' shops were empty and the only drugs available were of a bad quality. In 1917 there was an outbreak of tuberculous adenitis, in which suppuration very rapidly developed. The regions most frequently affected were the neck and neighbourhood of the sternum and ribs, where bone lesions and fistulae appeared. Involvement of the tracheo-bronchial glands was equally frequent, especially in young persons. Other forms of chronic tuberculosis occurred at the same time, among which the different varieties of tuberculous peritonitis held the first place.

Lemoine regards the lack of mineral salts in the food as the principal factor in the outbreak. Most of the population were deprived of green vegetables and consequently of the potassium, sodium, and iron salts which they contain, so that the food supply was not only much reduced in quantity but its quality also was defective.

**Hilus tuberculosis in the adult** is discussed by Riviere, who applies the term to a fresh and active process involving the deep areas of the lung in which the foci of childhood infection persist and thence spreading outwards to the surface. It is closely related to the common form of tuberculosis in childhood, though it has less tendency to glandular involvement, and is in striking contrast to the apical phthisis of adults, which is a localized infiltration involving the apex of the lung. Its principal clinical features are: (1) Its bilateral nature, though one or other lung may be more affected for a time. (2) The apical location of surface signs. The signs may appear at any point in the chest wall, and no spot is really characteristic. (3) The characteristic spread of the stethoscopic sounds over the lung surface. Having once reached the surface the signs tend quickly to spread over the greater part of that side, front and back, often within a comparatively few weeks. The diagnosis is chiefly established by percussion, whereby the following signs are elicited: (1) reflex bands of impairment over the back; (2) slight difference of note between the two sides of the chest; (3) a well-marked parasternal dullness indicating enlargement of the lateral tracheal and tracheo-bronchial glands; (4) bilateral narrowing of Krönig's isthmus of apical resonance at the top of the shoulder; (5) diminution or absence of tidal movement at one or both bases. On auscultation there are no signs in the earlier stages, or at most fleeting pleurisy or basal crepitations, followed at a later stage by granular breath-sounds over a wide area changing to crepitations. Hilus tuberculosis is nearly always of the peribronchial type and of extreme chronicity, with a tendency to spread over wide areas. The following variations from the type of hilus tuberculosis already described may be met with: (1) hilus tuberculosis accompanied by bronchitis; (2) hilus tuberculosis in association with tuberculosis of manifest glands such as the cervical and axillary; (3) hilus tuberculosis of a bronchopneumonic type.

The frequent localization of tuberculosis in the region of the pulmonary fissures is emphasized by Piéry, who shows that much information of diagnostic and prognostic value can be derived from the systematic examination of these regions. The importance of tuberculous lesions in these situations is shown by the frequency and variety of the post-mortem findings, such as interlobar adhesions, caseating or pneumonic processes close to the fissures, sero-fibrinous or purulent pleurisy, localized pneumothorax, and relapsing tuberculous pleurisy, a mild form of tuberculosis frequently found in soldiers, which is rarely found at the base or apex but is commonest close to the fissures. The frequency of lesions in this situation is also shown by radioscopy.

The frequency of pulmonary tuberculosis among the coloured soldiers and labourers brought to France in the course of the war is dealt with by Moreau, who states that the disease was all the more likely to escape detection as their general condition did not appear to be affected for a considerable time. The change of climate, however, the relatively hard work in comparison with their previous idle life and change of diet accounted for the rapid course of a disease which was clinically latent, although there was unmistakable radiological evidence of its presence, such as cavities, interlobar pleurisy, and enormous enlargement of the mediastinal and hilar glands. This condition explains why the broncho-pulmonary form of influenza was very rife and attended with a high mortality in the camps of the colonial labourers. Moreau adds that the X-ray examination used in France for detecting the lesions, which were often very advanced and necessitated immediate repatriation, might have been employed with still greater advantage before the men's enlistment.

The value of **chest fluoroscopy** is also emphasized by Diemer and MacRae, who urge that this method of examination should not be considered merely as an adjunct in diagnosis, but should be used primarily to detect abnormalities in the chest, especially in wholesale examinations when only a few minutes can be devoted to each individual. From April 1, 1918, to August 10, 1918, 13,893 chests were screened by the writers, and of these 425 were rejected on account of pulmonary tuberculosis.

Commenting on Diemer and MacRae's paper, Matson points out that careful physical examination generally predicts the X-ray findings. The latter are of little value alone unless interpreted by one having a knowledge not only of röntgenology but also of tuberculosis from a clinical and pathological standpoint. As compared with careful physical examination, X-ray examination even when carried out by an expert occupies a place of secondary importance, so far as the diagnosis of tuberculosis in military service is concerned.

In an article on radioscopy in soldiers suspected to be tuberculous Détré relates that of 844 men 676, or 80 per cent., showed no changes on radioscopic examination. Of the 168 positive cases 135, or 80·3 per cent., showed changes at the apex on one or both sides, the right being affected in 73 cases, or 54 per cent., the left in 41, or 30·3 per cent., and both apices in 21, or 15·5 per cent. Twenty-four, or 14·2 per cent., of the positive cases showed pleurisy with effusion; in 7 cases the effusion was not accompanied by any other change, and in 17 there was an opacity of the apex on one or both sides. In 43 there were more or less definite signs of pleurisy at the base of the lung, which brings up the total number of cases with pleural involvement to 39·8 per cent.

Dumas describes an unusual form of tuberculosis which he observed at Salonika among the black troops from Senegal and also among the Arabs from North Africa. The pathological features of the condition were as follows: The mediastinal and peribronchial lymphatic systems were first affected and subsequently the pleura and pericardium. The glands were at first merely enlarged, but later became caseous or suppurated. At the onset there were no lesions of the pulmonary parenchyma, and even later there were only a few scattered tubercles, but the ulcero-caseating form of the disease was never found. The lesions in the spleen were of interest as it was apparently in this organ that the lesions passed from the lymph into the blood-stream. When the spleen was normal there were no granulations or tubercles in the lung, but when the spleen was invaded the lung was also affected.

Clinically the cases were remarkable for the rapidity of their course. The longest duration of any case was three months, but most of the patients died in a much shorter time, death being due to progressive cachexia or to stoppage of the heart from pericarditis or compression of the cardiac nerves. The temperature was generally of a hectic type, apart from any suppuration. The sputum was profuse, sero-mucous in character, and often tinged with blood. Tubercle bacilli were usually not found. On auscultation as a rule only diffuse bronchitis was detected, and there was nothing to indicate a localization of the lesions. Radioscopy, on the other hand, allowed the diagnosis of mediastinal adenitis to be made. It is obvious from the above description that this type of disease is closely allied to that frequently found in children, whom the black resembles in so many respects.

**Tuberculosis and vaccination.** That the existence of pulmonary tuberculosis is no contra-indication to the performance of vaccination when this is required during a small-pox epidemic is shown by the experience of Mark (1), who vaccinated 200 patients with pulmonary tuberculosis, 70 of whom were in the first stage, 83 in the second, and 47 in the third. About 50 per cent. gave a positive result. Most of the patients were examined three or four weeks after vaccination, and in no cases were any changes found incompatible with the usual course of tuberculosis. The results in far advanced cases could not be differentiated from those obtained in the first and second stages, and it would therefore seem that these cases should not be exempted from vaccination.

Wiese arrived independently at similar conclusions from vaccination of 220 patients in a sanatorium in Germany, 23 per cent. of whom were in the first stage, 46 per cent. in the second, 26 per cent. in the third stage, and 5 per cent. had glandular tuberculosis. In none of the cases did an anergic period occur, although the reactions were well marked in all cases. Only two patients developed any striking symptoms within the period of observation, viz. aggravation of the disease in the upper lobe and haemoptysis, but in neither case could the symptoms be attributed to vaccination.

**Tuberculosis and influenza.** Numerous papers have recently appeared on the occurrence of influenza in the subjects of pulmonary tuberculosis, and with few exceptions the writers are agreed that influenza does not have the injurious effect with which it was formerly credited. Creischer confirms Rickmann's observations (vide *Medical Supplement*, 1919, **2**, 174) as to the generally mild course of influenza in tuberculous patients by his experience at the Augusta-Viktoria Sanatorium at Cologne. During the autumn epidemic 29 of the 200 patients contracted influenza. In most of the cases, in which all stages of tuberculosis were represented, the attack of influenza had no ill effect. Only two patients died, one being a case of artificial pneumothorax of the left side and extensive disease of the right lung, which was complicated by influenzal broncho-pneumonia; and in the other a mild attack of influenza was followed by tuberculous meningitis. In contrast with the mild course of influenza among the patients was the severe form which it assumed in the district and also among the members of the staff, in whom it was found that those who had formerly had tuberculosis stood the attack as well as the patients, while in those whose lungs had previously been healthy the disease was severe and almost always complicated by pneumonia and severe enteritis. A possible explanation of this occurrence was the fact that the tuberculosis patients came under treatment sooner than the staff, who worked on till the last. Another suggestion made by Creischer is that the tubercle bacillus reacts to the causal agent of influenza by the creation of specially active anti-bodies.

Von Hayek, officer in charge of a Red Cross Sanatorium near Innsbruck, states that during the first epidemic in 1918, which broke out in the middle of June, 67 of his 215 tuberculosis patients contracted influenza. Hardly any of the nurses escaped during the first fortnight, and a large proportion of the domestic staff also fell ill. In about half the cases the disease ran a mild course. The benign chronic fibrotic forms of pulmonary tuberculosis did not show any special tendency to severe pulmonary complications and did not suffer any permanent damage from their attack of influenza. On the other hand, the proliferative forms of tuberculosis were very liable to severe pulmonary complications, especially when the tuberculous process was advanced. In the second epidemic von Hayek's sanatorium remained almost immune, there being only 11 cases from the middle of October to the middle of January 1919; five of these were mild, in six the disease was protracted, but only one proved fatal.

Bochalli, superintendent of the Lostau sanatorium near Magdeburg, states that during the July epidemic only 10 out of about 100 tuberculous patients developed influenza, and that in October, out of 150 cases, 21 contracted the disease. Of the 31 cases only four were fatal, three of whom were already suffering from serious complications, such as bronchiectasis, emphysema, arteriosclerosis, and artificial pneumothorax. In three more cases the tuberculosis was permanently aggravated by the acute disease, and in another three the aggravation was only temporary. In 21 cases influenza had no effect whatever on the tuberculous process.

Meyer gives an account of an outbreak of influenza in a sanatorium containing 274 inmates, of whom 213 were patients. Fifty-four cases occurred, representing about 20 per cent. of the entire population of the institution. There were six deaths, a mortality of a little over 11 per cent. The clinical picture did not differ from that seen in the non-tuberculous, and the average duration of illness in 46 of the cases which recovered was about six days. At the time of writing Meyer found it too early to say what effect the intercurrent illness had on the tuberculosis, but in at least seven of the cases there were indications of renewed activity of the tuberculosis and an extension of the original process.

Fishberg (1), who has had a very similar experience to that of Meyer in a sanatorium containing 136 patients, maintains that the previous views in regard to influenza in tuberculous patients have not been borne out by experience during the recent epidemic. The mortality of influenza among his tuberculous patients was about 4 or 5 per cent., which was not higher than the mortality among non-tuberculous persons. If the tuberculous lesion was inactive the patient had the same chance of recovery as any other person, while if it was active and the fever high the influenza was liable to prove fatal.

St. Clair Thomson also declares that influenza does not appear to be the deadly peril it was formerly regarded for the consumptive, if the patient is promptly confined to bed, efficiently treated, and the supply of fresh air is not curtailed.

Deusch of Rostock found that in 28 or four-fifths of his 35 cases, the course of tuberculosis was in no way aggravated by the supervention of influenza, and that in one-fifth of the cases the tendency to repair was not interfered with. The few cases (seven) in which influenza tended to aggravation of tuberculosis were chiefly in young persons in whom the tuberculous process was only a few months old. Development of tuberculosis in persons whose lungs had previously been healthy was extremely uncommon; in the only case seen by Deusch the patient had been debilitated by delivery and lactation. As regards the incidence of influenza it did not appear to be higher among tuberculous patients than in persons whose lungs were normal.

On the other hand, Ménard in a paper read before the Medical Society of the Paris Hospitals expressed the view that the prognosis of influenza in tuberculosis was always serious. Of 41 tuberculous patients under his observation who contracted influenza, 18 died, 9 became worse, and only 14 were not affected. In the subsequent discussion Bernard remarked that Ménard's experience was exceptional, and summarized the current views on the subject as follows: (1) Establishments for tuberculous patients are much less affected by influenza than other communities. (2) In the few tuberculous patients who contract influenza the attack is usually slight and the mortality low. (3) Tuberculosis is not as a rule aggravated by intercurrent influenza. A similar view was expressed by Siredey, who had been much impressed by the mild course of influenza in obviously tuberculous subjects. This was in striking contrast with the epidemic of 1889–90, when influenza showed a predilection for patients debilitated by other diseases, and contributed to hasten the course of tuberculosis.

Voisin and Benhamou agree with Ménard as regards the gravity of the association of tuberculosis with influenza, and state that influenza, like measles, often rouses dormant tuberculosis into activity. During the epidemic of March and April they saw many patients develop sero-fibrinous pleurisy, and numerous cases in which death was due to pleuro-peritoneal or acute miliary tuberculosis.

**Tuberculosis and syphilis.** Elliott found that about 3 to 5 per cent. of the syphilitic patients in the Michigan University Hospital showed evidence of tuberculous infection, and explained the low percentage by the fact that a very large proportion of the cases were seen in the primary or early secondary stages of the disease, tuberculosis in his experience being more commonly associated with the older syphilitic lesions. Other writers quoted by Elliott report a much higher incidence of tuberculosis in syphilitics. 70 per cent. of Tedeschi's cases of tuberculosis developing during a period of ten years occurred in a luetic soil, and 19 per cent. of Letulle's tuberculous patients gave a positive Wassermann reaction. Bronfenbenner examined 193 syphilitics for tuberculosis with Besredka's tuberculous antigen, and found that 83 cases, or 43 per cent., were positive. 55 of these were clinically tuberculous, while 28 were not diagnosed. On the other hand, among 432 non-syphilitic cases 100, or 23·15 per cent., were tuberculous. He therefore concluded that tuberculosis was much more frequent among syphilitics than in non-syphilitics. Elliott points out that mercury should be used with great care in tuberculous patients, as its deleterious effect is not immediate but appears several months after the drug has first been given. He records 12 cases to show that arsphenamine (salvarsan) is the drug of choice in such cases, but should be given in small doses, as the ordinary dosage accentuates active foci and is prone to cause a flare-up in latent lesions.

Sergent points out that inequality of the pupils in syphilis is not always a sign of involvement of the nerve centres or a prodrome of tabes or general paralysis. It may sometimes be associated with an apical pleurisy resulting from pulmonary tuberculosis. In syphilitic subjects tuberculosis very often assumes the type of sclerosis of the apex and in most cases is accompanied by a pleural reaction of the same nature and tendency. Most of the patients show a supraclavicular adenitis, which is symptomatic of apical pleurisy or pleuro-pulmonary apical fibrosis. Some of them also present at the same time an inequality of the pupils, which may be either a transient dilatation connected with an attack of subacute pleurisy or a permanent myosis due to destruction of the dilator fibres by a fibrosing cicatricial lesion. In such cases, therefore, inequality of the pupils is only indirectly connected with syphilis. It should be regarded as the effect of pulmonary tuberculosis, the development of which has been favoured by syphilis.

**Wounds of the lung and pulmonary tuberculosis.** The relation of tuberculosis to wounds of the lungs has been discussed by several writers in the course of the war (vide *Medical Supplement*, 1918, **1**, 13 *a*, 68 *a*, 139 *a*, 184 *a*, 217 *a*), the consensus of opinion being that the tendency of these wounds to be followed by tuberculosis is infinitesimal. In a note based on the study of 420 cases illustrating the sequels of chest wounds Cordier also concludes that traumatic pulmonary tuberculosis is a rare event. A genuine case must satisfy the following conditions: (1) An aetiological criterium: there must be a definite and duly verified injury with an interval of three to four months between it and the onset of pulmonary signs, a satisfactory general condition after the wound, a short stage of suppuration, and only a brief stay in hospital. (2) A pathological criterium. There must be a well-localized tuberculous lesion, unilateral as far as possible, and in an unusual position exactly corresponding to the site of the wound. (3) The wounded man must have no family or personal history of tuberculosis, and his general health as well as his pulmonary condition must have been excellent at the time he was wounded. Cordier has met with only two cases which fulfilled these conditions. On the other hand Challamel states that pulmonary tuberculosis may develop as a secondary infection in patients with wounds of the lung owing to the diminution of pulmonary ventilation caused by the more or less prolonged immobilization of the thorax. In his opinion any wound of the lung may be the starting-point of a tuberculous process several years after the wound. He therefore regards all cases of pulmonary tuberculosis following a war wound of the thorax and commencing in the wounded lung as a remote consequence of the wound. He records several cases in which bullet or shell wounds of the lung were followed after a varying period by the development of pulmonary tuberculosis.

In a series of 226 wounds of the lungs Frankenburger met with six cases of active tuberculosis as a sequel of the wound in patients who had shown no evidence of active tuberculosis on admission, but had developed it two or three months later, suspicion having been aroused by an incomplete recovery and rise of temperature and the diagnosis confirmed by clinical examination and X-rays. In four cases a bullet had passed through the apex of the lung, and in two, in which there had been haemoptysis of long duration, the lower lobe was involved, the wound in one case having been caused by a bullet and in the other by a bomb.

Campani and Bergolli describe two new methods of detecting whether a pulmonary apex is affected by tuberculosis.

(1) Temporary asymmetry of the respiratory murmur on changing from the horizontal to the sitting posture. The writers have often observed that the weak sounds at the affected apex are barely if at all audible at first and that it is only after about two minutes that respiration at the affected apex becomes audible. The probable explanation of this phenomenon is

that the localization of the specific process at the apex causes a loss of vascular elasticity which gives rise to a transient mechanical engorgement, the signs of which soon disappear when the patient sits up.

(2) Determination of the height of the apex by auscultation. This method consists in determining the upper limit of the apex by comparing the pulmonary with the tracheal respiration. In the affected lung the highest point at which the vesicular murmur becomes audible is lower down on the sound side owing to sclerotic processes and infiltration.

Considerable value has been attributed to the **albumino-reaction** in the sputum in the diagnosis of pulmonary tuberculosis. Durand's observations, however, tend to show that it does not possess any special diagnostic value, as he has found it present in cases which were proved to be free of tuberculosis by clinical examination and negative laboratory tests. Thus in 15 cases of nasopharyngeal catarrh, 8 cases of lobar pneumonia, 10 of bronchopneumonia, 4 of acute pulmonary congestion, and 10 of passive pulmonary congestion secondary to heart disease the reaction was always positive. On the other hand the test has a prognostic value, as a positive reaction in a tuberculous subject indicates activity of the morbid process, the quantity of albumin being related to the extent and depth of the lesion.

**Amenorrhœa** is regarded by Schwermann as an early symptom of tuberculosis, as it is found not only in advanced cases, but very often at the onset and frequently as the only manifestation of the disease. It constitutes a defensive measure on the part of the organism, as on cessation of the menses a function is suspended by which resistance to disease is periodically weakened. Morland and Urwick have shown that the periodic fall of the opsonic index gives rise to an aggravation of the disease. If therefore the amenorrhœa is cured by treatment, not only is the tuberculosis unfavourably affected, but also the self-defence of the organism overthrown. Schwermann therefore recommends that patients who seek advice for amenorrhœa should have their chest examined after a gynaecological examination has proved negative.

A case illustrating the reactivation of erythema nodosum by tuberculin is recorded by Chauffard and Girard. A woman, aged 31, the subject of old Pott's disease, followed by tuberculous osteitis of the femur, had an attack of erythema nodosum, haemoptysis, and involvement of the right apex. An intradermal tuberculin reaction was then performed, a solution of 1 in 1,000 being given in error instead of a solution of 1 in 10,000. The complete picture of erythema nodosum was then reproduced including fever, multiple arthralgia and generalized erythematous nodules. The writers conclude that erythema nodosum is a *tuberculinoma* and that the associated joint lesions are a toxi-infective pseudo-rheumatism directly associated with tuberculosis.

In his thesis on the **cuti-reaction** to tuberculin, Patte shows that though it ceases to have any diagnostic value above the age of three years, and is almost invariably positive in the adult, the reaction possesses considerable prognostic value at all ages. Apart from a temporary disappearance connected with an attack of measles or whooping cough a negative reaction indicates a severe form of tuberculosis. A cachectic reaction which is characterized by an ecchymotic appearance of the papule is found in the fibro-caseous form of tuberculosis, and warrants a very guarded prognosis. A vesicular reaction, on the other hand, is the sign of a recent and mild infection. The best examples of it are to be found in sero-fibrinous pleurisy and erythema nodosum. In exceptional cases it is seen in persons presenting all the appearances of perfect health, when it probably indicates a recent mediastinal adenopathy.

As the result of the study of 500 cases of tuberculosis at the Ohio State Sanatorium, Mark (2) found that the amount of involvement being equal, the prognosis of lesions of the left lung was not as good as of the right. In the right lung the tendency to fibrosis was much more frequent than in the left, in which the more active spread of a tuberculous focus was due to the following causes. The left lung is considerably smaller than the right and has only two lobes. The bronchus leading to the left lung forms a more obtuse angle and is much smaller than the right bronchus. There are two fissures on the right, and only one on the left. The interlobar clefts fence in the infection and prevent one lobe from becoming infected by the other, except through the regular channels along the bronchial tree.

In an article on the expectation of life in pulmonary tuberculosis with special reference to pensions assessment, Picken shows that the expectation of life in males aged on the average 30 years, notified in Glasgow as suffering from pulmonary tuberculosis, is about 3½ years. The expectation of life of male cases at a sufficiently early stage of the disease to raise hope of recovery is about 6½ years. The expectation of life of male sanatorium cases discharged with the disease 'arrested' is about 14 years. Picken suggests that all cases of tuberculosis in discharged soldiers and sailors should be assessed in three grades: (1) those with actively progressive disease as measured by the general condition, physical signs, bacteriological and X-ray examination, at 100 per cent.; (2) those in whom the disease is arrested at 50 or 60 per cent.; (3) intermediate cases, i.e. those of low activity such as the chronic fibroid type, at 70 or 80 per cent.

Joltrain and Baufle draw attention to the occurrence of localized **latent peritoneal tuberculosis** in patients with vague abdominal symptoms. The pain is not violent, but there is rather a feeling of discomfort, increased by food, diminished by a strict diet and rest in bed, and often most marked in one of the iliac fossae. Diarrhoea is more frequent than constipation. The general condition is characterized by emaciation, asthenia, low arterial tension, and anaemia with mononucleosis. X-ray examination which is essential for the diagnosis shows a dilatation of the lower end of the ileum, in which there is an obstruction to the passage of the bismuth meal. As a rule the dilatation of the ileum is associated with immobility of the colon due to the existence of adhesions which are found not only in the region of the ileum but also throughout the large intestine, especially at the flexures, and in the sigmoid. The presence of adhesions is confirmed *post mortem*, when tuberculous granulations may sometimes be found.

Keppler and Erkes record cases to show that tuberculosis of the mesenteric glands may simulate a variety of intra-abdominal diseases; thus caseous and calcified glands in the ileo-caecal angle may not infrequently give rise to symptoms resembling appendicitis, and affection of the glands in the mesentery and transverse meso-colon may occasionally simulate disease of the stomach and duodenum. A special search should therefore be made for tuberculous mesenteric glands when an exploratory operation is otherwise negative. The ideal procedure is removal of the glands without damaging or resecting the gut. Treatment by X-rays is contra-indicated owing to the glands breaking down and perforating.

**Treatment.** The intravenous injection of 5 c.c. of a 5 per cent. solution of **calcium chloride**, which was first advocated by Saxtorph in the treatment of intestinal tuberculosis is recommended in early cases of this condition by Fishberg (2), who states that when the diarrhoea has continued only a few weeks it can be checked by this method much better than by any other medication or dietetic changes, and even the abdominal pain may be removed. When the diarrhoea and pain had been present for several weeks repeated injections of calcium chloride caused a slight reduction in the frequency of the stools, but no improvement was noted in the abdominal pain. The mode of action of calcium chloride cannot be explained by the theory of lime starvation which is said to be a strong aetiological factor in tuberculosis, because the administration of calcium chloride has no influence on the other symptoms of phthisis. On the other hand, Loeb found that calcium salts stop contact irritability of muscle, and the hypersensitiveness of the nervous system induced by various salts. It has also been observed that calcium salts impede and even stop completely intestinal peristalsis; at times they even counteract the action of certain laxative drugs.

Lo Monaco's treatment of tuberculosis by intramuscular injection of **saccharose**, which has been advocated by several Italian and French authorities (vide *Medical Supplement*, 1918, **1**, 296; *ibid.*, 1919, **2**, 130, 175) has recently been employed by two Swiss writers, Bodmer and von Schulthess-Rechberg who found that it produced a great diminution in the amount of expectoration. Bodmer who treated 14 cases of pulmonary tuberculosis with a total of about 500 intramuscular injections of saccharose states that as the solution passes through the organism without being absorbed or even inverted, it is obvious that a direct action on the tuberculous infection cannot be expected.

Saccharose therefore cannot be regarded as a cure for tuberculosis. In none of his cases did it have any decided action upon the febrile temperature, nor was any definite influence upon the general condition perceptible, but the diminution in the amount of the sputum with consequent relief of the cough was very striking. Von Schulthess-Rechberg found that the treatment had the same effect, the amount of sputum in his cases being reduced from 20–80 per cent. Gerber used the same treatment for 22 cases of hyperidrosis in advanced phthisis. The doses consisted of 10 c.c. of a 50 per cent. solution of cane sugar in sterile water with the addition of a 2 per 1,000 novocain. A single injection was usually sufficient for weeks, and in only one or two cases was it necessary to repeat the injection in 4–7 days. A painful infiltration often developed at the injection site and lasted for 48 hours, but disappeared without suppuration under cold applications. With the exception of a single case which was complicated by malaria, the sweating ceased at once for weeks in 17 cases, and the remainder said that they were less troubled by sweating than before the injection. No definite explanation of the action of saccharose could be given. There was no increase in the daily amount of the urine excreted.

At a meeting of the Frankfort medical club on December 2 Stephan stated that he had used **Friedmann's remedy** in more than 600 cases without any bad results. The injection was always given subcutaneously, 0·3 c.c. of the strong emulsion being given, except in the cases of children, who received smaller doses. Stephan agreed with Friedmann and Goepel that the treatment should be started as early as possible. It was mostly indicated in the initial stage, in numerous cases in the second stage it was followed by improvement and even cure of the disease, but it was ineffective in the third stage.

Philipsborn reports a case of tuberculosis of the kidney and bladder cured by his treatment, the patient being in good health six years after the injection. Blumenthal treated nine cases of Pott's disease in children, aged from 3–14 years, by subcutaneous or intramuscular injection of the vaccine and concluded that the remedy possessed great value, but urged that it should be given in early cases before deformity has set in.

Windrath, on the other hand, is less enthusiastic. Of 23 cases of pulmonary tuberculosis treated with the remedy in 1913, one had died of haemoptysis a fortnight after the injection, 4 could not be traced, 3 were still alive in December 1918, though two of them were in a bad general condition and showed active tuberculosis, and 15 had died, all with one exception before the outbreak of the war, so that a lack of food could not be incriminated.

(Abstracts of other articles on Friedmann's vaccine will be found in *Medical Supplement*, 1918, **1**, 346 *a*, 346 *b*, 390 *b*, 391 *a* ; *ibid.*, 1919, **2**, 130 *a*, 130 *b*, 174 *b*, 175 *a*.)

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J. D. R.

## SURGERY OF THE THYROID AND THYMUS GLANDS

1. **Causation.** Farrant correlated the changes in the thyroid gland found *post mortem* with the diseases which caused death. In deaths from other causes the thyroid gland was observed to be unchanged.

In children dying from diarrhoea, diphtheria, measles, broncho-pneumonia, and whooping cough, changes in the direction of hyperplasia were found, similar to those produced in guinea-pigs by the injection of diphtheria antitoxin, or by feeding the animals on powdered thyroid gland. The diphtheria antitoxin produced the same effect as the thyroid feeding; it evidently contained thyroid secretion in excess of normal serum. This is explained by the fact that the horses used for producing the antitoxin present evidence of thyroid hyperplasia. Besides the above, the toxins produced by the bacilli of anthrax, dysentery, tetanus, glanders, acute tuberculosis, and the micrococcus catarrhalis, also the toxins of malaria, secondary syphilis, cirrhosis of the liver, and chronic nephritis, are a cause of marked hyperplasia of the thyroid.

On the other hand, the micro-organisms of typhoid fever, the pneumococcus, staphylococcus, and streptococcus, the septic toxins from wounds and such general diseases as carcinoma and sarcoma, Addison's disease, diabetes, jaundice, blood disease, lymphadenoma, and lymphatic leucocythaemia do not produce changes in the thyroid gland. Intermediary, causing slight changes, are the toxins of coliform bacilli, chronic tuberculosis, actinomycosis, tertiary syphilis, meningococcus, rheumatic fever, scarlet fever, acute anterior poliomyelitis, chronic nephritis, pernicious anaemia.

McGarrison held that endemic disease of the thyroid gland is caused by toxins derived from the intestinal tract of goitrous patients or produced by faecal decomposition, whether internal or external to the body. Toxins from the intestinal tract of the goitrous mother act on the foetal thyroid and parathyroid glands; the maximal and rarer effect is to produce cretinism, the more common minimal effect is to set up congenital goitre and parathyroid disease.

He estimated that of the offspring of goitrous parents a few were born cretins; 63 per cent. were born with congenital goitre, a half of whom had parathyroid disease; the remaining 33 per cent. had normal thyroid and parathyroid glands.

Herring found that the feeding of animals with thyroid gland excited an excessive metabolism together with hypertrophy of the adrenals, so that the blood contained an excess of adrenalin. The administration of adrenalin relieves some of the symptoms of exophthalmic goitre; if continued it tends to reduce the activity of the thyroid gland, and ultimately to induce hypothyroidism. The hypertrophy of the adrenals may therefore be regarded as compensatory, directed to the countering of hyperthyroidism.

Kimball and Marine, at Akron, Ohio, a goitrous district, in the course of examining 3,872 schoolgirls, found the thyroid gland of normal size in 43·5 per cent.; it was slightly enlarged in 49·8 per cent., moderately enlarged in 6·3 per cent., and markedly enlarged in 0·18 per cent. To a proportion of the girls they gave sodium iodide, 2 gm. to the younger ones and 4 gm. to the elder, divided into 10 doses. As compared with the girls who were not so treated, there was a striking improvement in the direction of diminution of the enlarged thyroid, an absence of fresh enlargements, and no drawbacks. There were no instances of the development of hyperthyroidism; only five out of 1,000 girls had a rash, and that was evanescent. They proposed to repeat the dose of 2 gm. after six months.

2. **Pathology.** a. *Colloid hyperplasia.* The toxins excite an increased vascularity of the gland and an increased formation of colloid. The alveoli show several rows of cells which towards the centre of the alveolus lose their staining properties, become brown, break up, and turn into colloid. The formation of colloid in excess distends the alveolus into a vesicle lined by flattened epithelial cells. The interalveolar connective tissue does not at first change unless as a result of the increased vascularity, then there is extravasation of blood, and the haemorrhage is followed by intervesicular fibrosis. Also the haemorrhage destroys gland tissue.

b. *Complete hyperplasia.* The colloid fails to stain, becomes granular, vacuolated, and then disappears. With this the alveoli shrink, their wall is plicated, and the epithelial cells from being cubical tend to appear columnar and to fill the alveolus. The interalveolar connective tissue is more highly vascular, inflammatory small round cells collect, and there are more marked tendencies to haemorrhagic extravasation. As compared with colloid hyperplasia, complete hyperplasia results in a solid vascular tissue with an absence of vesicles and colloid.

Further changes following hyperplasia are:

(1) A return to the normal.
(2) A reproduction of colloid, as described under colloid hyperplasia.
(3) An intervesicular fibrosis with atrophy of gland tissue.

The fresh secretion of the thyroid gland is fluid and passes from the gland into the veins, not into the lymphatics. It contains iodine in a compound proteid molecule. The colloid in the vesicles may be looked upon as a reserve of iodine and the vesicles become distended with colloid when iodine is administered or when iodine is contained in the food.

When the gland is stimulated to overaction by a toxin, or when the diet, such as meat, is poor in iodine, then the gland gets rid of its colloid containing iodine.

**Nervous influence on the thyroid gland: action and reaction.** Langdon Brown described the influence of the sympathetic nerve upon the thyroid gland and the effect of the absorption of an excess of thyroid secretion upon the nervous system.

Sympathetic fibres reach the gland along its blood-vessels from the superior cervical ganglion, also by way of the superior and inferior laryngeal branches of the vagus. Excitation of the sympathetic has a katabolic action. Cannon, experimenting on cats, joined the central end of the divided phrenic nerve to the peripheral end of the divided cervical sympathetic, in order that a stimulus should pass to the gland with each breath. The cats developed tachycardia, excitability, loose motions, and exophthalmos on the side of the experiment. There was increased metabolism, and enlargement of the adrenals.

Stimulation of the gland by way of the sympathetic nerves has the effect of:

(*a*) emptying the colloid reserve;
(*b*) causing compensatory hypertrophy of the gland;
(*c*) heightening the excitability of the nervous system.

Hence a vicious circle is established, the excess of thyroid secretion stimulates the sympathetic, and the over-excitability of the sympathetic stimulates the thyroid.

The stimulation of the sympathetic by the thyroid secretion is shown by the protrusion of the eyeball caused by the spasmodic contraction of the protrusor bulbi muscle of Müller, by the rapid pulse, by the sweating, and by the diminished secretion of gastric juice.

The compensatory excitation of the adrenals, causing an excess of adrenalin in the blood, is indicated by the raised blood-pressure, and by the tendency to glycosuria and to pigmentation of the skin.

The over-stimulation has on the superior cervical ganglion the same effect as that produced by age—hyperpigmentation, chromolysis, fibrosis, and atrophy of the ganglion cells.

The over-excitability induced in the nervous system is shown by emotional excitement, staring eyes, drawn-down angles of the mouth, and tremors.

The influences therefore affecting the thyroid are nutritional, toxic, and emotional. Within physiological limits the action of the thyroid gland is protective; when in excess the above influences promote pathological changes.

**Exophthalmic goitre.** Hildebrand's experience in Berlin was that among 2,000 goitre operations 500 had been on cases of exophthalmic goitre; he had examined besides 150 cases, altogether 650 cases.

He distinguished:

(*a*) Slight cases which he termed 'vagotonic', with a little tachycardia and exophthalmos, accompanied by diarrhoea and sweating, also by eosinophilia and lymphocytosis.

(*b*) Severe cases termed 'sympatheticotonic' with marked tachycardia, forcible heartbeat, marked exophthalmos, glycosuria, and fever, but without diarrhoea, sweating, or eosinophilia.

(*c*) A marked enlargement of the thymus with little thyroid enlargement.

The development of exophthalmic goitre was very often preceded by thyroid enlargement which might be congenital in origin; the mother or other members of the family may afford evidence of emotional disturbances, nervous disease, and actually of exophthalmic goitre.

In the patient the development of exophthalmic goitre may be preceded by nervous disturbances of various kinds—headache, attacks of giddiness or fainting, shortness of breath, sleeplessness, loss of sensation in the arm or leg, perverseness, hysteria, melancholia—some one symptom, irritability of the heart, insomnia, local sweatings and flushings, wasting, &c., may long precede the actual onset. Mental disturbances preceding exophthalmic goitre may occur in connexion with an accident, or death, or lover, or money trouble, or fright, or strain. Lately have been added war troubles, anxiety about relatives, or food.

The acute infections which have been followed by exophthalmic goitre are erysipelas, scarlet fever, puerperal fever, tonsillitis and quinsy, articular rheumatism, pericarditis, measles.

Lymphocytosis, when present, points to an enlargement of the thymus, but it is not a constant sign. The accompanying enlargement of the thymus introduces the danger of the status lymphaticus. The occasional signs of sympathetic paralysis, a narrowing of the pupil, also of the palpebral fissure, or unilateral stimulation causing hyperaemia and sweating of the face, may be due to pressure on one side. The presence of sugar in the urine is of grave importance; it may indicate true diabetes accompanied by excessive desire for food and drink, and there may ensue an atrophy of the pancreas. Even if not severe, glycosuria is easily set up by taking grape sugar, &c.

Late and consequential complications render the prognosis grave, such as dilatation and weakness of the heart, with oedema of the feet, dyspnoea, and cyanosis.

Hildebrand's cases of exophthalmic goitre had been previously under medical treatment, but had only been relieved temporarily.

As to X-ray and radium treatment, when pushed there formed adhesions fusing muscles, capsule, and goitre together; there were signs of necrosis in the superficial layers of the gland; also the skin had been affected by eczema and teleangiectasis. Fatal cases of acute swelling, 'thyreodismus', had occurred.

**X-ray examination.** Examination by X-ray is of importance as showing the effect of pressure upon the trachea, also as disclosing an enlarged thymus or retrosternal goitre. The lumen of the trachea may be examined by direct, or more generally by indirect, laryngoscopy. Denk and Hofer said that, among 1,967 operations for non-malignant goitre in Vienna between 1901 and 1917, in 11 cases there was softening and collapse of the trachea necessitating tracheotomy.

An X-ray photograph taken anteroposteriorly will show the commoner lateral compression of the trachea, but a lateral photograph is necessary in order to demonstrate the rarer anteroposterior compression. The X-rays photograph will also show the situation of the most severe compression. Tracheoscopy, by counting the rings down from the cricoid cartilage until the appearance of the tracheal rings is lost and the wall bulges in with movement of the mucous membrane in respiration, supplies a way of detecting a commencement of softening, and suggests an early operation in order to avoid the necessity for tracheotomy. This cannot, however, be avoided when the softening is extensive.

Sgalitzer described his method by which lateral and anteroposterior X-ray photographs could be taken so as to show lengthening and bending of the trachea by the goitre as well as the level and extent of the compression.

Mayer found that X-ray photographs also enabled a diagnosis to be made of intrathoracic goitre and enlarged thymus, although a dermoid cyst cannot be distinguished from the above. The retrosternal goitre may be a continuation of the goitre in the neck, but an intrathoracic goitre may exist without any enlargement of the gland in the neck. Moreover, accessory thyroids may be met with at any point in the line from the base of the tongue as far down as the front of the arch of the aorta and pericardium, or even in the posterior mediastinum. Oehler noted that when the growth in the thyroid was malignant, the outline of the trachea as seen by the X-rays was obscured or was not visible at all. This is probably due to dense infiltration around the trachea. The obscuring of the trachea by cancer is distinct from the question whether the cancer is compressing the trachea.

**Local anaesthesia.** Surgeons accustomed to the administration of general anaesthesia by experienced anaesthetists will not be impressed with the descriptions of operations under local anaesthesia. Even when the patients do not feel much, they soon become exhausted and, in the latter part of the operation, very restless. Rouquette advocated local anaesthesia except in the case of large goitres, when he uses ether through an intratracheal catheter. Morphine with hyoscine was injected one and a half hours before and a second dose of morphine one hour before, and the patient's ears plugged. For the local injection he used 200 c.c. of a 1 per cent. solution of novocain, to which he added potassium sulphate to the extent of 2 per cent. and suprarenin not exceeding 24 minims of the 0·1 per cent. solution. The infiltration of the skin was done with a fine hypodermic needle after applying a pad of 1 in 20 carbolic acid. The deeper injections with long spinal anaesthesia needles was done superficial and lateral to the capsule, but not within the capsule nor behind the gland. Restlessness and dyspnoea during or after the operation was combated by injections of strophanthin and adrenalin, sore throat by lozenges and ice, headache by aspirin, thirst by fluids.

The temperature was always raised after the injections for a week or so and might continue irregular for a longer period. The drainage tube was removed after two days. Both suppuration and recurrent haemorrhage were rare unless more than 24 minims of the adrenalin solution was injected. Rouquette attributed the main influence to the adrenalin in combination with a quantity of fluid.

Hildebrand adopted local anaesthesia alone in most of his cases after a preliminary dose of scopolamin or chloral hydrate. The injection of 0·5 per cent. solution of novocain with the addition of adrenalin followed Braun's directions. In many cases there was a marked tendency to swallowing movements, perhaps because the adrenalin increases the secretion of saliva. The restlessness during the latter part of the operation should be met by sufficient scopolamin or chloral hydrate beforehand, not by morphine, which is a danger to the heart. In one case the patient died on the table before the local injection was finished and before any incision had been made.

**The ligature of the thyroid arteries.** In severe cases of exophthalmic goitre Mayo commenced by tying both superior thyroid arteries. A transverse incision is made across the middle of the thyroid cartilage through the platysma and deep fascia so as to expose the inner border of the sternomastoids. On retracting these muscles outwards, the anterior belly of the omohyoid is exposed on each side. When this muscle is retracted inwards the upper pole of the lateral lobe on each side is exposed and a ligature is placed around so as to include the tip of the gland along with the branches of the artery and vein. The ligature of the superior thyroid higher up is likely to fail owing to the excessive anastomoses. No drain is required. If necessary the inferior thyroid arteries may be tied subsequently through a transverse incision between the sternal heads of the sternomastoids. The sternomastoids are retracted and the inferior pole of the gland lifted up so as to expose the artery as it appears from behind the carotid before entering the gland. Rogers especially advocated the ligature of two or more of the thyroid arteries. He had done the operation in order to relieve hyperthyroidism in 296 cases, 169 of which were cases of exophthalmic goitre. There were nine deaths, a mortality of 3 per cent. Of the 128 cases about which a subsequent report was obtained 102, i.e. 70 per cent., were described as cured, 18, i.e. 14 per cent., improved, and 8 unimproved. He confined excision in such cases to those in which there was pressure on the trachea. The inferior thyroid arteries were the ones first ligatured, which was done through a three-inch incision along the posterior border of the sternomastoid at its lower end. After dividing the external jugular vein, the outer border of the scalenus anticus was reached, then the sternomastoid, with the carotid, internal jugular, and vagus, were drawn inwards and, by blunt dissection in front of the scalenus anticus, the inferior thyroid artery was found at the inner border of that muscle, near its origin from the thyroid axis. The artery was ligatured in continuity, but not cut across, owing to its deep situation. A reason given for preferring to tie the inferior instead of the superior thyroid was that the latter operation was followed by painful deglutition.

In 19 out of Hildebrand's 500 operations for exophthalmic goitre the ligature of both superior thyroid arteries sufficed, and no further operation was required.

**Cervical sympathectomy.** This operation, which has of late years been little practised, is referred to by C. H. Mayo as employed in cases showing markedly the nervous symptoms attending exophthalmic goitre, but with the thyroid gland remaining small. An incision is made over the bifurcation of the carotid, the sternomastoid muscle is retracted outwards, the carotid sheath and internal jugular vein inwards. Next the vagus nerve is identified. This is necessary, for otherwise its lower ganglion may be mistaken for that of the sympathetic. The superior cervical ganglion is then exposed, its upper end cut or torn out, also its lower branches, which may be followed to the middle ganglion and that also removed.

**Thyroidectomy.** C. H. Mayo said that up to June 15, 1914, there had been operated upon for goitre 6,868 cases, and of these 3,295 presented hyperthyroidism. The mortality after operation had been reduced down to 1–3 per cent. Local and general anaesthesia were used in combination; if ether is employed, an injection of $\frac{1}{100}$ gr. of atropin should be given beforehand. In a severe case of exophthalmic goitre scopolamin and morphia should be injected an hour beforehand: if after that the patient's condition is unsatisfactory it may be wise to postpone the operation.

After making a low collar incision and separating the sternohyoids down the middle line, there may be a sufficient exposure for a small operation. If not, the sternohyoids and the sternothyroids should be divided transversely at the level of the thyroid cartilage, not only to prevent an indrawing of the scar, but also to preserve their nerve-supply. The lateral veins are divided between clamps and then the gland is drawn forwards so as to divide the blood-vessels at the upper pole, followed by those of the isthmus. In order to control the vessels towards the lower pole, especially in exophthalmic goitre, the capsule should be incised, the margins of the capsule seized with forceps, and then a partial enucleation done of the lower part of the lateral lobe. This modification avoids setting up haemorrhage difficult to control, whilst the recurrent laryngeal nerves and the parathyroids are protected.

Hildebrand met with 16 deaths among 500 operations for exophthalmic goitre, i.e. a mortality of 3·2 per cent. Two of the deaths were attributed to chloroform, one to bronchitis and pneumonia set up by ether, two occurred after local anaesthesia when only the arteries were ligatured, six had an enlarged thymus, in which there was restlessness, dyspnoea, and a rapid pulse before death: seven had an enlarged thymus accompanied by an enlarged spleen and red marrow; one had secondary haemorrhage with compression of the trachea, and one had emboli at the bifurcation of the carotid and splenic arteries. As to the results in 250 cases, 125, i.e. 54 per cent., were cured; 79, i.e. 34·3 per cent., were much improved; 25, i.e. 10 per cent., had improved; 25, i.e. 2 per cent., had improved a little.

In 11 cases it was necessary in the course of the operation to do tracheotomy, but this did not complicate the wound in any way. In doubtful cases tracheotomy is the safer measure.

Orth, of Forbach, had operated upon 300 cases of goitre, with five deaths. He carefully sutured over the stump of the gland to prevent the escape of colloid and closed the wound without drainage. In 116 healing occurred without disturbance; in 39 a haematoma formed; in 23 serum collected. His report shows that the general practice of inserting a drain for a day or two is the better plan.

Wilms reported on 2,100 cases of thyroid surgery, 1,650 seen at Heidelberg, and 450 at Basel. 242 had been operated upon during the preceding year. Among 759 cases of goitre operated upon during the previous four years there had been only two deaths. In operating he was particularly careful to seize the margins of the capsule with numerous forceps which would not tear as Kocher's forceps were apt to do. He had come to excise from both sides at the same operation. In vascular and exophthalmic cases, besides the above care for the capsule, he ligatured the inferior thyroid artery between the carotid artery and the gland, and left a piece of the lower pole of the gland on each side, the size of a walnut. In that way he had had no case of tetany from injury to the parathyroids.

A substernal goitre was approached by a slow and methodical ligature of all vessels. He had never adopted Sauerbruck's proposal to remove the manubrium.

**Thymectomy.** Enlargement of the thymus along with exophthalmic goitre was noted by Markham in 1858 and by Goodhart in 1873 (Roussy). Besides this, there are transitional cases with the status thymolymphaticus, and a persistent or enlarged thymus may complicate lymphatic leucocythaemia (Major).

The removal of part of the enlarged thymus of young children was described by Veau in 1911. He distinguished the stridor produced by the compression of the enlarged thymus from laryngismus stridulus. Out of seven cases in which the cause was an enlarged thymus the drawing up of the gland from behind the sternum and cutting it partly away gave relief in six, one dying of bronchopneumonia. In three children operated upon the cause was found to be enlarged tracheobronchial glands, and one child died following this exploration.

Schumacher and Roth, at Zürich, in a woman aged 21, with a marked exophthalmic goitre, found signs of an enlarged thymus, which was confirmed by an X-ray examination. The case was complicated by great muscular weakness and malaise. The patient was kept in bed for 10 weeks and carefully dieted, then one superior thyroid artery was tied. No improvement followed, and the muscular weakness so increased that the patient could not stand and could hardly lift her arm. The writers attributed the myasthenia to the enlarged thymus. Under general anaesthesia by ether Sauerbruck divided the sternohyoid and sternothyroid muscles, and, after retracting the sternomastoids, exposed a soft goitre covered with numerous large veins. Then the finger was passed down behind the sternum until 1 cm. below the notch the finger reached a resistance. This was loosened by using an elevator and was then seized with clamp forceps, which allowed of an opening being made into the capsule of the thymus. The finger was next passed into the capsule and the gland partly separated so that a heart-shaped piece 4·2 × 2·7 cm. could be dragged out. Next a sausage-shaped mass, 8 cm. in length, was withdrawn and considered to be the left lobe. Another piece, 4 cm. in length, was removed and taken to be the right lobe. The three pieces altogether weighed 49 gm. and the structure was that of a foetal thymus. There had been hardly any bleeding; a small drain was inserted and the wound sutured. After this thymectomy the patient slowly improved, so that four months later she was enabled to return home. She could then stand alone and walk with support. The exophthalmic symptoms were a little less marked. Nine months after the operation the patient could go upstairs and walk several hundred paces. A year and a half after the operation she could walk for an hour and a half. Then the exophthalmic symptoms increased and the whole of the right lobe with the isthmus and the lower part of the left lobe was excised. She bore the operation well, the exophthalmic symptoms definitely improved, and her muscular strength further increased.

v. Haberer, of Innsbruck, operated upon the thymus in five cases of exophthalmic goitre; in four the operation was a combined partial removal of the thyroid and thymus. In a fifth case the thymus alone was removed and there was a rapid improvement.

Capelle, of Bonn, was also successful in giving relief by removing the thymus without touching the thyroid.

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## GASTRIC AND DUODENAL ULCERATION

In Germany as well as in neighbouring neutral countries, Switzerland and Sweden, there has been a marked increase in the number of those suffering from dyspepsia and gastric and duodenal ulceration. Hence many communications have appeared which aim to decide moot questions by statistical collections of hospital cases. For a complete review, however, the evidence from the statistics is inadequate, the cotemporaneous results of medical treatment, whether in-patient or out-patient, including the number of deaths, would require to be collated with the evidence from the surgical point of view.

**The increased frequency.** Rosenthal, among 5,000 patients a year in the Darmstadt hospital, had before the war an experience of one to two patients annually, suffering from perforation of gastric and duodenal ulcers. During the previous half-year there had been 10 cases. He attributed this to hyperacidity, induced by an excess of vegetable food over that of milk and eggs, meat and fat. Similar observations have been made by others.

**Causation.** There is general agreement that hyperacidity is present in the majority of cases, but there is little fresh evidence as to the origin of the hyperacidity, as to whether it is the cause or the effect of the ulceration, or whether a vicious circle is established. Besides hyperacidity there is the question of sepsis, which appears at any rate to be connected with the jejunal ulceration. Thirdly, some writers have recurred to the vague suggestion of a nervous influence.

Traube explained the action of the hydrochloric acid in the gastric juice as causing a swelling up of albumen and gelatin, so facilitating the action of pepsin. Albumen such as fibrin is acted upon and swells up under a weak solution, 0·015 per cent. or less, of hydrochloric acid. Casein and serum albumen require a strength up to 0·02 per cent. of hydrochloric acid in order that a rapid digestion shall occur. Stronger solutions act much more slowly and incompletely.

In the intestines the alkali acts in a similar fashion in relation to the pancreatic juice. The tests employed for the detection and estimation of lactic acid appear uncertain as regards the presence and the amount of other organic acids besides lactic acid. Therefore the constantly recurring word hyperacidity is still not well defined.

Grundelfinger instituted experiments bearing upon the subject of nervous influences producing the round ulcer of the stomach. The division of the vagus below the diaphragm or in the neck, also its stimulation at these points, caused no changes, either in the stomach or in the duodenum. The excision of one or both of the coeliac ganglia, however, induced defects both in the stomach and in the duodenum. An explanation suggested was that the unopposed vagus induced hypertonus and angiospasm, a local ischaemia, hence necrosis of the mucous membrane and haemorrhage. The excision of the coeliac ganglia was followed by hyperacidity; subsequently equilibrium was re-established and the gastric juice became normal.

Hart also attributed gastric and duodenal ulceration in young people to a spasm of arterioles through vasoconstrictor nerves, causing ischaemia and necrosis. In older people arteriosclerosis and complication such as gall stones had similar tendencies. Gastric and duodenal ulcers were alike in their origin.

Minkowski had excised the whole duodenum from dogs, and Grey did the same. The excision was combined with a transplantation of the common bile duct and of the pancreatic duct into the jejunum. Provided that the pancreas was untouched no harm happened to the dogs.

**The diagnosis of gastric and duodenal ulceration.** The differentiation of **duodenal ulceration** was first made by Moynihan in 1901. His patients presented a definite history which enabled a diagnosis to be made. Further experience published in 1907 and 1910 confirmed him in his assurance as to the diagnosis. Mayo Robson, however, in 1907, said that the diagnosis of duodenal ulceration was ambiguous and difficult. Of great importance was Moynihan's statement that medical treatment had no influence on duodenal ulceration; on this point all subsequent writers have confirmed Moynihan's opinion. But as to the diagnosis of duodenal ulceration the general experience has been that the various points are all uncertain. Numbers of writers have discussed the relative certainty or uncertainty of the different signs emphasized by Moynihan. The increasing experience gained by X-ray examination has become an important feature in the discussion.

Stated briefly, the following were the chief points in Moynihan's description which have given rise to controversy: that duodenal ulceration was of more frequent occurrence than gastric ulceration; that it chiefly occurred on the anterior wall of the duodenum just beyond the pylorus; that men are more frequently affected than women; the occurrence of the so-called hunger pains one and a half to four hours after a meal, whether after the morning, midday, or evening meal, with acid eructations; the pain referred to the right of the middle line of the epigastrium, a little above and slightly to the right of the umbilicus and striking round to the back of the chest on that side; the relief of the pain by taking food or an alkali; the explanation of this pain as due to the escape of gastric juice unneutralized by the food into the duodenum; the periodicity of the attacks corresponding presumably to the healing and recurrence of the ulceration; hyperchloridia as a particular indication of duodenal ulceration: the occurrence of melaena including 'occult' blood.

The interest started in Germany by Moynihan's original publication received an exhaustive review in 1913 by Küttner, at the 42nd Congress of the Deutsche Gesellschaft für Chirurgie. The discussion disclosed many differences of opinion and left various questions unresolved. At the outset the German surgeons differed from Moynihan as to the relative frequency of gastric and duodenal ulcer: it was generally agreed that gastric ulcer was far the more frequent in Germany, about 2·4 to 1. Before Moynihan's paper a great number of the duodenal ulcers had been included under the diagnosis of ulcerations about the pylorus. There is one explanation of this difference of opinion, viz. the difficulty of deciding as to the exact position of the pylorus, especially when the anatomical conditions are obscured by disease. Hence some observers may include among gastric ulcers what others would recognize as ulcers at the commencement of the duodenum.

v. Haberer found that, not only in Germany but also in America, opinions differed widely as to the special importance of the signs and symptoms of duodenal ulceration; with the exception of Sherren, few surgeons had endorsed Moynihan's views. Even when the special signs correctly indicated duodenal ulceration, Haberer concluded that they were produced by pyloric irritation and spasm. The only point on which there was general agreement was the greater gravity of duodenal over gastric ulceration, and that in spite of the fact that malignant changes are common in gastric ulceration; they are quite rare in ulceration of the duodenum in its usual situation, viz. in the first part of the duodenum. Sex and age, a previous history relating to the periodic recurrence of the symptoms over a long period, the hunger pain, the hyperacidity, the occult and obvious melaena, the pain and tender spot to the right side of the middle line of the epigastrium, the diminished movements as shown by the X-rays, each and all had proved untrustworthy in relation to the diagnosis of duodenal ulceration. As frequently as not these signs occur with other conditions.

Haberer's observations included 129 cases, 86 males, 43 females. Only in 29 out of the 129 was there any preceding illness which might be connected, such as puerperal fever, typhoid fever, appendicitis, cholecystitis, nervous disturbances. The only case giving a history of intraperitoneal septic inflammation was one in which suppuration had followed an operation for hernia, and the omentum was found to have become fixed in the left inguinal ring, so tying down the stomach. Certainly the sign most often connected with the duodenal ulceration was that of periodic recurrence of attacks, separated by quiescent intervals. This sign was present in 53 out of the 129. Hunger pain was complained of in 27 cases, and the pain in the middle of the night in 19 out of the 129. But the relation of pain to food was on the whole quite uncertain. Only 22 complained of pain at the spot considered typical. The rest had had pain, often quite vague, at spots extending over a wide area including the left side of the epigastrium, the upper abdomen, the shoulder, and sacrum. 49 had a tender spot, but not exactly pointing to the duodenum; often it was on the left side, suggesting gastric ulcer, or over the gall bladder, or appendix. 70 complained of vomiting on occasions, 26 of occurrences of haematemesis, 38 presented evidence of hyperacidity, 12 of a reduction of acidity below the normal, 41 showed under X-ray examination signs of diminished mobility, but only in four cases did the X-ray examination and the diagnosis agree. There was found occult blood in about half the cases;

probably it would have been found in more than this number had they been examined. Only five presented rigidity of the right rectus muscle. In ten cases a lump was actually felt which subsequently proved to be an indurated duodenal ulcer, but in all this lump was considered beforehand to be either an enlarged gall bladder or a malignant pylorus, for it occurred with symptoms not considered characteristic of duodenal ulceration. Among the 129 cases there were found multiple ulcerations in 31, in five there was more than one ulcer in the duodenum, the rest had gastric ulceration in addition to the duodenal, at various spots between the cardia and pylorus. The most noteworthy condition found when operating was a narrowing of the duodenum as the result of chronic callous ulceration.

Reinhard's Hamburg statistics included 10,000 post-mortem examinations. Ulcers or characteristic scars were found in the stomach and duodenum in 293 cases: in the stomach in 228, i.e. in 2·2 per cent., and in the duodenum in 65, i.e. in 0·6 per cent.

Of the cases of which there had been no ante-mortem note 189 were in the stomach and 47 in the duodenum, altogether 236 out of 293, i.e. in 80 per cent. Among the 228 instances in the stomach there were 54 scars; among the 65 instances in the duodenum there were two scars. This points to a less tendency to a scarring and to a more unfavourable prognosis for duodenal ulceration.

Of 68 cases in which an *ulcer of the fundus of the stomach* was found at the operation, the history had been: in 35 classical of gastric ulcer; in 9 classical of duodenal ulcer; in 24 general of dyspepsia. In 44 only was there manifest or 'occult' haemorrhage. Of the 60 subjected to X-ray examination: in 49 there was a positive diagnosis of gastric ulcer; in 2 of pyloric ulcer; in 3 of duodenal ulcer; in 6 it was negative.

Of 36 cases in which the *ulceration* was found *at the pylorus*: in 12 cases there was a classical history of gastric ulcer; in 10 cases a classical history of duodenal ulcer: in 14 cases a general history of dyspepsia. In 21 only of the 36 was there manifest or occult haemorrhage. Of the 28 cases submitted to an X-ray examination: in 20 the diagnosis of pyloric ulceration was made: in 5 of duodenal ulcer; in 1 of ulcer of the lesser curvature of the stomach; in 2 the examination was negative.

Of 33 cases in which a *duodenal ulcer* was found at the operation: in 15 there was a classical history of duodenal ulcer; in 18 a classical history of gastric ulcer. In 21 only was there manifest or occult haemorrhage. Of 27 cases examined by X-rays: in 8 the diagnosis of duodenal ulcer was made; in 9 of pyloric ulcer; in 2 of ulcer of the lesser curvature of the stomach; in 8 the examination was negative.

Of 13 cases in which at the operation there was made a doubtful diagnosis of duodenal ulcer: in 2 there had been a classical history of duodenal ulcer; in 11 a general history of dyspepsia: in 8 only had there been manifest or occult haemorrhage.

Of 9 cases in which *pyloric stenosis* was due to scarring: in 2 cases there was a classical history of gastric ulcer; in 7 cases a general history of dyspepsia; in all the 9 cases the X-ray examination gave a positive diagnosis of pyloric stenosis.

Melchior recalled attention to the varieties of duodenal ulceration which are likely to escape the attention of surgeons. At post-mortem examinations duodenal ulceration is more commonly found on the posterior aspect, with an extension of the ulceration to the head of the pancreas.

The signs of ulceration in this position are often latent and death occurs frequently from haemorrhage. Besides this, duodenal inflammation and superficial ulceration are found in old people who have died exhausted by cardiac and vascular disease, malignant, cerebral, tuberculous, or skin affections.

Ulceration on the anterior wall of the duodenum, unless it perforates, tends to heal and then to recur; gradually the margins become callous, and it is particularly such patients, with a long history of periodic recurrent attacks, who come under the notice of surgeons.

The stenosis which follows upon duodenal ulceration is liable to be confused with pyloric stenosis; cases are put into the latter category by some, which others would call duodenal. Hence duodenal stenosis has been stated to be of rare occurrence.

**Gastric pain and the innervation of the stomach.** The stomach is innervated through the oesophageal branches of the vagus. Its afferent fibres in connexion with the nucleus in the medulla oblongata conduct impulses which excite sensations of nausea. By spreading to neighbouring nuclei there is produced the concomitants of nausea, secretion of saliva, pallor, sweating of the face, and disturbance of the heart, with a tendency to faint. These afferent impulses produce reflex movements of the stomach, diaphragm, and abdominal wall, vomiting and hiccough. Irritation of the stomach with the vagi intact produces vomiting, although the splanchnics have been divided, whilst conversely it cannot be so produced after the division of the vagi, although the splanchnics are intact. It is then necessary, in order to excite vomiting, to stimulate the vagus nucleus or the upper end of the divided vagus. On the other hand, painful sensations are not conducted by the vagi.

The innervation of the stomach through the sympathetic furnishes the means of conducting afferent impulses, both physiological and of pain. Sensations of emptiness and hunger, also of repletion, as well as sensations of pain, pass through the sympathetic fibres and ganglia of the coeliac plexus to the white rami communicantes belonging to the ninth, tenth, and eleventh thoracic spinal segments. Entering the spinal cord by the posterior roots and passing through the posterior to the lateral column, the afferent impulses reach the optic thalamus. Dogs deprived of the cerebrum and anencephalic foetuses react vigorously to gastric stimulation, showing an independence as regards the cerebral cortex. The ability to localize a spot of skin touched depends upon a continuity connecting the spot with the cerebral cortex. There is, therefore, an explanation of the uncertainty and difficulty of localizing the seat of pain in the stomach.

Referred pain from the stomach has been explained by Head and MacKenzie.

Local anaesthesia has been produced experimentally on dogs, and in the hands of some it has been adopted instead of general anaesthesia when operating. The injection of novacain and suprarenin into the intercostal nerves belonging to the segments involved produces anaesthesia of the abdominal wall. This anaesthesia may last for 1½ hours, especially if beforehand the patient has had a dose of morphine and scopolamin. If, further, the novocain solution is injected into the region of the coeliac ganglia above the lesser curvature of the stomach, operations may be performed without a general anaesthetic. Indeed, according to Wendling, this injection may be carried out through the undivided abdominal wall by inserting the needle 5 mm. to the left of the middle line, and 1 cm. below the tip of the xiphoid cartilage. The needle is passed directly backwards, and 50–80 cm. of a 1 per cent. novocain and suprarenin solution injected.

Finsterer used paravertebral injections and expressed opinions in favour of the exclusive use of local anaesthesia when operating.

As a result of irradiation in the posterior horns from the sympathetic to the spinal system, there is produced hyperalgesia of the skin and muscular rigidity. The skin is not hyperaesthetic; it is not especially responsive to all irritations, but to pricks and pinches. The area of irradiation showing hyperalgesia can be marked out. The pinching up of the skin excites a special reflex contraction of muscles supplied by the same level of the spinal cord.

**Gastric spasm and X-ray examinations.** Greater experience with the appearances reproduced in X-ray photographs and their interpretation has added to the means of making a more exact diagnosis, as well as the recognition of spasm and its causation of pain.

Müller attributed gastric pain, especially during the emptying of the stomach, to irregular spastic contraction of the pyloric third of the stomach, as shown by the X-rays. But also, whilst the stomach is empty, spasmodic contractions occur, which may be the cause of the so-called hunger pain. The spasmodic contraction may involve not only the muscular wall of the stomach but also the gastric arterioles. The gastric crises in tabes dorsalis may be explained as due to strong peristaltic and antiperistaltic contraction of the walls of the stomach.

Indeed, the production of pain by hyperacidity may be exaggerated. The normal mucous membrane in dogs is not specially irritated by hydrochloric acid, even in excess of the normal, and there are many ulcers of the stomach which do not cause pain.

Fleiner, by X-ray examination, explained cardiospasm as starting in the oesophagus and spreading to the cardiac portion of the stomach. No special sphincter was recognized at the cardiac orifice. By means of spasmodic contraction a tube was formed along the lesser curvature of the stomach leading towards the pylorus. The tube so formed was reminiscent of the normal condition of this part of the stomach in ruminants. A continuance of the occurrence of spasm of the lower third of the oesophagus and upper part of the stomach might lead to the formation of cancer with dilatation of the oesophagus above the region of spasm.

Schütze stated that in 60 per cent. of cases suspected of gastric ulcer the X-ray photographs presented indentation of the greater curvature of the stomach, which he attributed to hypertonic contraction of the gastric wall with an infolding of the mucous membrane. Whilst in the majority of cases gastric ulceration was indicated, it was also seen in connexion with duodenal ulceration, and less often with cholecystitis.

Groedel, however, did not agree with Schütze; indeed he doubted whether such pictures of indentation could be taken as signs of pathological conditions at all.

**The treatment of gastric and duodenal ulceration. Gastrojejunostomy.** The general adoption of posterior retrocolic no-loop gastrojejunostomy has resulted in that operation becoming the surgical measure most commonly adopted. In the large majority of cases the patients experience immediate relief; it is the safest operation, especially in weak patients. The fear of cancer supervening is negligible in the case of the duodenum: the tendency of some recent communications is to lessen the fear of cancer supervening, upon a chronic ulcer of the stomach; indeed the old view has been resuscitated that cancer of the stomach is not preceded by simple ulceration. But disappointments after gastrojejunostomy have been reported by many physicians, who have seen the patients some time after the operation. These patients had experienced relief for a time and then the old symptoms returned. Indeed, some have been again relieved by having the gastrojejunostomy undone.

Moynihan continues to advocate gastrojejunostomy as the operation *par excellence.* In his last 300 cases for non-malignant disease, he had not lost a case. Disappointment after the operation may be due to:

(*a*) Absence of any lesion justifying the operation.

(*b*) Atony and prolapse of the stomach. Vomiting continues with the alteration that the vomit contains bile. The stomach is emptied too rapidly, which causes intestinal uneasiness and diarrhoea. The short-circuiting should be undone and the case treated by a belt or corsets.

(*c*) Chronic disease elsewhere is overlooked, especially appendicitis and cholelithiasis. Apart from particular symptoms, both these affections may be complicated by dyspepsia, hyperacidity, flatulence and heaviness after meals, and by haematemesis. Cirrhosis of the liver is likewise accompanied by dyspepsia, flatulence, heaviness, soreness, frequent eructations, loss of appetite, haematemesis or melaena, often profuse. In splenic anaemia there is also profuse haematemesis.

Patients have had gastrojejunostomy performed for the gastric crises in tabes dorsalis, but in one such case there actually was a duodenal ulcer and gastrojejunostomy was done. It had also been done for vomiting which was occasioned by pregnancy; in another case for lead poisoning: in others for a loose kidney, colic adhesions, or a small epigastric hernia.

(*d*) Defects in technique. A long jejunal loop proximal to the opening, or the kinking or twisting of a short loop, sets up regurgitant vomiting. The opening should always be 2½ inches in length; it should be at the back of the stomach but close to the greater curvature; it should be in line with the oesophagus; the jejunum should be so fixed that it will assume a vertical position when the patient sits up or gets about; the sutures closing the opening in the mesocolon should fix the edges to the stomach or to the anterior line of the anastomosis, and not to the jejunum, for otherwise the jejunum may be drawn up through the hole in the mesocolon into the lesser peritoneal cavity and form a sharp kink.

Moynihan considered that the results of gastrojejunostomy could hardly be improved, so that he rarely practised either excision of ulcers or exclusion of the pylorus, or partial gastrectomy or duodenectomy. In the case of a duodenal ulcer large blood-vessels running over the ulcer should be ligatured, the outer surface infolded and covered with omentum, when it may be anticipated that the ulcer will quickly disappear. As for cancer supervening upon a chronic ulcer after gastrojejunostomy, he had only experienced a single case, and that was thirteen years after the operation.

For a large chronic gastric ulcer burrowing towards the liver or pancreas, or near the cardiac end of the stomach. he inserted a tube into the jejunum below the gastrojejunostomy opening, and fed the patient exclusively into the jejunum until the appearance under X-ray examination suggested that the ulcer had healed. It may be few or many months; in one case the jejunostomy tube was used for two years and nine months.

Garnett Wright said that disappointments after gastrojejunostomy were attributable to:

(1) Atonic dyspepsia with gastroptosis in the absence of pyloric stenosis.

(2) Ulcers of the lesser curvature which require excision or partial gastrectomy.

(3) Chronic duodenal ulceration without stenosis unless the pylorus is excluded or the ulcer excised.

Rowden, a radiologist at Leeds, said that his experience was confined to X-ray examinations of cases which had not recovered after gastrojejunostomy. In such the gastrojejunostomy opening seemed to act all too well. The stomach emptied in 5–10 minutes, and he presumed that the intestines resented the entry of undigested food. Symptoms of dyspepsia had recurred as long as two to three or even seven years after gastrojejunostomy. Cases in which symptoms had not recurred exhibited a much slower emptying of the stomach, so that he had said cynically that gastrojejunostomy is most successful when it does not work.

Robert Hutchison had been consulted as a physician by cases unrelieved by gastrojejunostomy, or in whom some time later symptoms had recurred. The patients complained of feelings of distension or of emptiness of the stomach, of the food appearing to drop straight down, of nausea like constant seasickness, of regurgitation, weakness, prostration, loss of weight, loose and frequent stools. These symptoms might be explained by (*a*) ptosis: (*b*) the pylorus becoming patent after being occluded; (*c*) atony in which the stomach emptied too fast. In four of his cases the gastrojejunostomy opening was reclosed. Frequent stools might be relieved by medical treatment. A vicious circle had now become rare and might be relieved by washing out the stomach. If not, it was necessary to re-operate.

Pain returning after some months, becoming severe and constant, and spreading round at the back was often put down to adhesions, but it suggested jejunal ulceration and a further operation was then indicated.

Hort said that it was necessary to distinguish gastroduodenal ulceration into the recent and the recurrent. The recent might be due to gastrolytic toxins produced in connexion with dental stumps, pyorrhoea alveolaris, maxillary antrum empyema, or infected kidney or lung. In such it was the removal of the cause, not gastrojejunostomy, which was necessary. The cases for gastrojejunostomy were the chronic indurated ulcerations, impossible of repair, setting up mechanical troubles, even although the primary cause had been eliminated.

In two cases after a posterior retrocolic no-loop gastrojejunostomy a fatal circulus vitiosus occurred, and Dubs found that this was due to a dilated and prolapsed stomach which kinked the descending loop of the jejunum. This might have been avoided by combining the anastomosis with gastropexy and reduplication of the stomach wall.

Exalto was of much the same opinion as Moynihan, based on an experience of 208 cases during six years, except that he aimed to make the anastomosis near the pylorus. More severe methods are attended by a higher mortality and yet do not cure a larger percentage. Of the 208 cases of gastrojejunostomy only four had haemorrhage after, and only two developed cancer. Four cases, i.e. 1·9 per cent. died, one of haemorrhage 20 days after the anastomosis, the ulcer having already penetrated deeply into the pancreas, one eight days after, owing to previously marked exhaustion and anaemia; one was a delayed death from the anaesthetic, and one died of embolism. The highest death-rate recorded recently for gastrojejunostomy was 6 per cent.; the lowest death-rate after excision and other operations was about 25 per cent., only in a few cases 10 per cent.

Bausch was also in favour of gastrojejunostomy with a mortality varying according to cases from 2–12 per cent., whereas the mortality following excision of the ulcer was 20–33 per cent. Medical treatment was estimated to involve a death-rate up to 25 per cent., and chronic ulcers had been found to become ultimately malignant in as many as 43 per cent. of the cases, whereas after gastrojejunostomy cancer rarely supervenes—in not more than 6 per cent.

**Duodenal ulceration treated by excision and by pyloric exclusion with gastrojejunostomy.** v. Haberer had come to adopt excision in the treatment of duodenal ulceration with an increasing frequency. He deemed the operation indicated when there was a likelihood of the ulcer perforating, or of setting up a peptic jejunal ulcer. So long as the common bile duct and the pancreatic duct were not disturbed he had undertaken the excision of the upper part of the duodenum, even although the ulceration had already invaded the head of the pancreas. The procedure employed followed Billroth's second method, the closure of the duodenum, and an anastomosis between a loop at the commencement of the jejunum and the cut end of the stomach.

Out of 129 cases of duodenal ulceration he had done this operation in 46. Four deaths occurred in exhausted patients, the operation area being found satisfactory after death. All the cases showed improvement after recovery from the operation; 28 were completely freed from digestive troubles; in 12 an improved condition persisted; two relapsed but had no other operation.

Forty-seven cases were treated by exclusion of the pylorus along with gastrojejunostomy. In most of the cases the method of exclusion followed that described by von Eiselsberg. The stomach was divided a little above the pylorus and the two cut edges invaginated. In two cases a gastric ulcer was excised as well. In four cases a gastroenterostomy had already been done, but the duodenal ulcer failed to heal until after the exclusion of the pylorus. Only one case died from exhaustion. Twenty-nine cases were freed from all symptoms and were well five years and more afterwards. Seven cases showed improvement. The unsatisfactory feature of the operation was the development of a peptic jejunal ulcer in seven cases (*v. infra*).

In 36 cases gastrojejunostomy only was done owing to the bad general condition of the patients, or because other surgical interference was necessary. In two cases a diseased appendix was removed, in one case the gall bladder was drained, in another excised, and in a third anastomosed. No case died. Ten lost all symptoms, 14 underwent definite improvement.

Horwitz, from an experience of 30 cases of gastrojejunostomy alone, deemed it unsatisfactory, owing to food continuing to pass freely through the pylorus. The closure of the pylorus by ligature or by crushing had only a temporary effect; subsequently food was seen to again pass through the pylorus.

**The treatment of gastric ulcer, especially of the lesser curvature, not involving the pylorus.** von Redwitz, from his experience at Würzburg, discussed the alternatives—gastrojejunostomy, excision including the pylorus, and excision of the middle of the stomach, the pylorus remaining. This latter operation he advocated, claiming in support experiments on dogs, in which the remainder of the stomach acted well and secreted a normal amount of gastric juice.

Between April 1907 and December 1917 there were operated upon for gastric and duodenal ulceration 321 cases, 144 being men and 177 women, viz. 96 gastroenterostomies: 195 excisions; 12 v. Eiselsberg's exclusion of the pylorus for duodenal ulceration in 11 men and 1 woman; 13 perforated ulcers; 2 hour-glass stomachs; 3 local excisions of the ulcer.

Of the 96 cases of gastroenterostomy, 59 were anterior colic gastroenterostomy combined with enteroanastomosis, and 37 posterior retrocolic gastroenterostomy without enteroanastomosis.

Six died, i.e. 6·2 per cent., two of peritonitis from leakage at the line of suture, three of pneumonia, and one of heart failure. Of the patients reported upon two years after the operation 58·5 per cent. were quite well, 25 per cent. had improved, 7 per cent. had not improved, and 9·5 per cent. had died, probably only two of cancer.

A collection of cases from several sources shows that gastrojejunostomy was followed by a good result in 73 per cent. of the operations done for duodenal ulceration, in 70 per cent. of those done for pyloric ulceration, but only in 50 per cent. of the gastrojejunostomies done for ulcerations of the fundus of the stomach. The relief which then follows may be due to the removal of the hyperchloridia and of pyloric spasm, the actual ulcer not being itself a cause of pain when not penetrating deeply. Also there seems less danger of an ulcer becoming carcinomatous when situated on the lesser curvature than when at the pylorus. The objection to gastrojejunostomy is that bleeding may continue, the ulcer may perforate, or a peptic jejunal ulcer may be set up, because of the acid and septic discharge from the ulcer. Of 195 cases of excision, 134 involved the middle of the stomach only, 61 included the pylorus. In addition there were three cases of local excision of the ulcer, all of which did badly.

Of the 134 cases submitted to excision of the middle of the stomach, especially for ulceration situated on the lesser curvature, 16 died and 118 recovered. Of the latter 90 were subsequently reported on: 61 were quite well, 15 had improved but still had slight dyspeptic troubles, 8 had not improved, and 6 had died.

Of the 16 who died after the operation, six died from peritonitis, in three because the pancreas had become involved, and the rest from pulmonary and other complications.

Of the six who died subsequently, the report said they had had no dyspepsic trouble, so that there was no sign that any had died of cancer. Among the recoveries were men who had been on active service in the war for one or two years without digestive troubles. Broadly speaking, gastrojejunostomy and the excision of the middle of the stomach had about the same results; the excision as an operation had more than double the danger of a gastrojejunostomy, but the later results were better. The excision of the middle of the stomach was less dangerous and had better results than the excisions which included the pylorus (*v. infra*).

Reinhard's experience of excision of the middle portion of the stomach was similar; among 22 cases, 19 recovered and 3 died, i.e. 13·6 per cent.

Balfour, at the Mayo Clinic, Rochester, Minnesota, described in 1914 the cauterization of ulcers of the lesser curvature as preferable to excision. From the outer surface, the centre of the ulcer was recognized by touch; this spot was perforated from without inwards by the cautery, which was then applied so as to burn away the margins of the ulcer. This done, Lembert's sutures were inserted in order to fold inwards the cauterized margin, and the line of sutures was covered over by a flap from the gastrohepatic omentum.

In 1918 Balfour reported 214 cases in which the cautery had been thus applied to destroy the margin of gastric ulcers. In favour of the procedure was the observation that after spontaneous perforation there is a tendency to spontaneous healing of the ulcer, presumably aided by the ingrowth of endothelial cells from the peritoneal surface.

The cauterization appears to afford a greater mobility to the stomach than that which follows excision or gastrojejunostomy. Balfour also concluded that the cauterization destroyed streptococci infecting the ulcer.

Among 186 cases there had been only two deaths, one from pulmonary embolism and one from pneumonia on the twentieth day. 80 per cent. appeared to be cured and 18 per cent. improved.

Among 89 excisions with the knife, there had been three deaths; 70 per cent. were apparently cured, and 18 per cent. improved. Before applying the cautery to perforate through the floor of the ulcer, a peritoneo-muscular flap should be raised on each side and protected from the heat. These flaps will facilitate the infolding.

Duval approved of Balfour's cauterization over excision. A case died later from empyema and upon examination all signs of what had been an extensive ulceration had disappeared; the stomach presented nothing abnormal. Delbet also praised the cauterization because excision of a wedge tended to produce an hour-glass constriction of the stomach.

In the discussion at the Société de Chirurgie, some favoured gastrojejunostomy only: Tuffier thought Balfour's cauterization indicated only for early and limited ulceration. Hartmann held excision best, and to avoid the tendency to hour-glass constriction he applied the sutures and drew upon the pylorus in the long axis of the stomach.

Diederichs from an experience of five cases, as an addition to gastrojejunostomy, infolded the stomach wall in a longitudinal direction, so as to push inwards a ridge which came into contact with the excavation made by the ulceration. The region of the lesser curvature was thus shut off from contact with the gastric contents which passed along the greater curvature towards the anastomosis. The five patients were relieved from symptoms of dyspepsia.

**Hour-glass constriction** forms a definite indication for excision of the middle portion of the stomach. Whenever a saddle-shaped ulcer on the lesser curvature has so advanced as to set up a transverse constriction both a wedge-shaped excision and Balfour's cautery excision are contraindicated.

Gastrojejunostomy, the anastomosis connecting the jejunum with the cardiac sac, leaves the contents of the pyloric sac liable to stagnation.

von Redwitz reported two cases of anastomosis between the two sacs—gastrogastroanastomosis—1½ years after the operation one woman was quite well, and at work. But more often there have been failures; obviously one is likely to set up small stagnant pouches. There is, moreover, a distinct liability to cancer supervening at the constricting ring. Lapointe and Dujarier both reported satisfactory results following excision of the middle portion of the stomach, including the constriction.

**The treatment of ulceration involving the pylorus and causing stenosis.** The most striking success follows gastrojejunostomy for ulceration at the pylorus. This is attributable to the efficiency of the anastomosis from a mechanical and drainage point of view. All the gastric contents leave the stomach by the opening, and so the ulceration at the pylorus is no longer irritated, there is relief from spasm, and the ulcer tends to heal. The relief is the more striking seeing that the symptoms of pyloric obstruction are unbearable and alarming.

Hirschberg reported a case complicated by a severe attack of tetany, which supervened upon severe vomiting and after a long history of dyspeptic trouble. The patient, a man aged 23, after losing much fluid by non-bilious vomiting without haematemesis, was seized with severe cramp in the forearms, hands, and feet, with pallor, cold sweats, and a quick pulse. For three days he did not pass urine. The hands assumed the position of the so-called obstetrician's hand. After doses of morphia and saline infusion a posterior retrocolic gastrojejunostomy was done. A callous ulcer had much narrowed the pylorus. Relief followed, with a free secretion of urine and all dyspeptic symptoms disappeared.

In two cases described by Boyksen an ulceration at the pylorus was followed by spasmodic closure. With this occurred such a spasm of the cardiac orifice that the stomach became ballooned by gas. Both were completely relieved by gastrojejunostomy.

Failures after gastrojejunostomy owing to atony and to prolapse have been referred to above. Gastropexy and gastroplication may be added to the gastrojejunostomy, in other cases excision of the pylorus is indicated. A relapse after gastrojejunostomy may be due to the ulcer not healing, and there is some liability to cancer supervening upon chronic ulceration. What comes practically to the same thing, it is more difficult at the pylorus than elsewhere to distinguish a simple from a malignant ulceration at an early stage.

von Redwitz reported 61 cases of excision which included the pylorus. In 50 cases Billroth's second method was followed: 9 died; of the 41 survivors, 34 were reported upon later; 18 were quite well, 10 had improved, 2 had not improved and had severe dyspeptic trouble, and 4 had died meanwhile. In 7 a modified Billroth II operation was done; all recovered from the operation. Of the 7, four were reported upon later; 3 were then quite well and 1 had improved. Two were operated upon by Kocher's modification, the remaining portion of the stomach was completely closed, and then the duodenum was implanted into a hole made in its posterior wall. Both recovered and one was reported later to be quite well. The two cases of complete excisions of the stomach died. Thus among 61 cases there were 11 deaths, i.e. a mortality of 18 per cent. Of the 9 cases reported by Reinhard 3 died, i.e. 33 per cent.

**The active treatment of acute gastric haemorrhage.** The patients are in an unfit state for operation, and the attempts at ligature have failed: the haemorrhage continues owing to free anastomosis, or on the contrary, ligation cuts off the circulation and necrosis ensues; excision is impracticable. It has become the general practice to put off surgical procedures.

A proposal was originated by v. Eiselsberg to make as quickly as possible a large gastrojejunostomy opening, 10 cm. in length, in combination with medical treatment for the acute anaemia and ulceration. Philipowicz described three cases which recovered. Finsterer reported 18 cases in favour of this procedure whenever there is a previous history suggesting gastric or duodenal ulceration; then, at the first severe haemorrhage, a large gastrojejunostomy opening should be made. If no such history is given, then the first acute haemorrhage should be treated medically, and a second haemorrhage awaited before operating. Should, however, no sign of gastric or duodenal ulceration be found during operation for a first acute haemorrhage, the anastomosis should not be made, but the question of diagnosis be further considered.

When the haemorrhage is the result of penetration of a duodenal ulcer into the pancreas, gastrojejunostomy fails by itself. The pylorus must be also excluded. If a gastric ulcer has penetrated deeply into the lesser omentum the gastric artery should be ligatured in addition to the gastrojejunostomy.

v. Haberer, in the course of 662 operations for gastric and duodenal ulceration, operated in 13 cases for acute haemorrhage; 9 recovered and 4 died, but in none of the latter did haemorrhage recur after the gastrojejunostomy. There were other cases, apparently moribund, which were not operated upon. During the same period, among 4,260 post-mortems there were two deaths from duodenal haemorrhage. Excision in such cases is quite impracticable. If no operation is done, it is important to keep the stomach empty by passing a tube and washing out the stomach. Distension of the stomach by blood provokes further haemorrhage—a vicious circle is established.

**The treatment of perforated gastric and duodenal ulcer.** The success of surgical treatment when an ulcer has perforated depends mainly upon the time which elapses between the perforation and the operation. An operation within the first few hours may be followed by recovery from the operation in all the cases. The main cause of delay is the absence of any previous history of dyspepsia.

Demmer reported 52 cases in the course of 10 years, 37 gastric and 15 duodenal, all close to the pylorus. Only three were women, and the ages were mainly between 30 and 35. The total mortality was 48 per cent.; among those done within six hours it was only 6 per cent. Many of the perforations occurred without any warning and without any obvious cause. There was a history of dyspepsia in 34 of the cases, but a diagnosis was only made in 13 out of the 52.

Among 13 cases operated upon by von Redwitz 5 died; 3 were sutured only, 2 died and 1 was cured; 10 had gastroenterostomy in addition, 3 died and 7 recovered.

Among Reinhard's cases, 37 of perforated gastric ulcers, 9 died, i.e. 24·3 per cent., but among those operated upon within the first 12 hours the mortality was only 7·6 per cent. Among 19 cases of perforated duodenal ulcer there were 8 deaths, i.e. 42·1 per cent., but there were no deaths among those operated upon within 12 hours.

Impressed by the danger of the subsequent development of a peptic jejunal ulcer owing to septic discharge from the ulcer, v. Haberer in two cases excised the pyloric region of the stomach, including the ulcer. in addition to gastrojejunostomy. Both recovered and left hospital within a month.

Eunicke treated three cases in the same way and all recovered.

**Duodenal stenosis.** Cautley described the congenital stenosis of infants which in 67 out of 92 instances was found at the level of the papilla of Vater, where it was doubtless due to an error in development. In a smaller group of cases the stenosis was at the duodenojejunal junction, where it may have either a developmental origin or possibly be due to antenatal inflammation. Many of the infants were born prematurely. A complete atresia is shown by an absence of meconium; if incomplete there is more often a narrow channel, rather than an annular constriction. As distinguished from congenital pyloric stenosis, there is a swelling caused by the dilatation of the upper part of the duodenum which is softer than the swelling due to pyloric stenosis. Also, if the stenosis is below the bile papilla, there may be bile in the vomit. One case was operated upon by Ernst of Copenhagen at the age of ten days; he made a duodeno-enteroanastomosis.

Urbach described an acute obstruction of the duodenum in its third part by the mesentery, including the superior mesenteric artery and vein. In his cases the small intestines, deprived of mesenteric fat, had sunk down into the pelvis and so dragged upon the jejunal mesentery. The attack of obstruction was immediately provoked by a large and indigestible meal. It resembled an attack of acute intestinal obstruction or of acute appendicitis, its distinguishing feature being an inflation of the stomach.

(1) An Italian prisoner, aged 32, had been ill for a week, and was very wasted. He had passed a small hard stool the day before, and had been vomiting for 24 hours. He had a pale dry tongue, an epigastrium like a board; the lower half of the abdomen, especially on the right side, was dull to percussion: all the abdomen was painful, especially on the right side. His temperature was 35·9° C. and his pulse-rate 56. He continued to vomit, the vomit being free from bile and faeces, and the tympanites increased until death. At the post-mortem it was found that there was no fat in the mesentery, the body being wasted and anaemic. The stomach and duodenum were enormously distended and contained many litres of fluid without bile or faeculent food débris; the pylorus was patent and the obstruction was at the crossing of the jejunal mesentery. The jejunum and ileum were filled with faecal fluid and gas, and there were hard scybala in the large intestines. Except for the wasting, there was no other affection.

(2) A man aged 48 had been under treatment for frost-bite of one foot, when he had sudden marked distension of the epigastrium with vomiting. His temperature was 36·3° C. and his pulse-rate 90. He was not markedly wasted. He refused to have a stomach-tube passed. The next day the stomach was distended to the umbilicus. He was then placed in the knee-elbow position; hot fomentations were applied to the abdomen; a rectal enema was administered and the tube left in position. Gas and motions escaped and the patient got all right at once.

(3) An Italian prisoner, aged 23, was ill for three weeks with diarrhoea and pain in the legs. He was wasted, anaemic, and had oedema of the face; his tongue was furred; the abdomen was tympanitic but not painful; there was no vomiting; he had frequent stools. His temperature was 36·2° C., his pulse-rate 80. He died, and on examination there was noted general wasting and anaemia, the stomach was greatly distended by gas and by a non-faeculent fluid not containing bile or food débris. The

duodenum was also distended as far as the crossing of the mesentery. Except that the mesenteric glands were swollen, nothing else wrong was found. Similar cases had been previously described by Vogels.

**Post-operative peptic ulcer of the jejunum.** Peptic jejunal ulceration following gastrojejunostomy is obscure in origin and is difficult to treat. Errors of technique can hardly account for its occurrence some time after recovery from the operation. It has been attributed to a persistence of hyperacidity, or to a recurrence of hyperacidity after a temporary reduction of acidity following the anastomosis. It has occurred when there has been no ulceration of the stomach nor of the duodenum, neither before nor subsequent to the gastrojejunostomy.

v. Haberer met with it as a complication of duodenal ulceration when treated by gastrojejunostomy and pyloric exclusion, and attributed it to septic toxins from the ulcer. Hence he favoured excision, for after that he had not met with jejunal ulceration.

Case I. A man aged 26 had had dyspepsia for 14 years, and an ulcer was discovered on the anterior wall of the pylorus, for which a posterior gastrojejunostomy was done. A year later he was found to have an ulcer on the mesenteric border of the jejunum right over the opening into the stomach, which had extended into the mesentery and was just on the point of perforating. The pyloric ulcer had not healed. Both the pylorus and the gastrojejunostomy opening were cut out. The upper end of the duodenum was closed, the distal end of the jejunum was joined to the stomach, which was otherwise closed, and the proximal end of the jejunum was implanted into the distal portion of the jejunum. The man reported five years later that he was 3–4 kilogrammes heavier and felt much better; he could eat things other than acid foods and those causing flatus.

Case II. A man aged 28, after dyspepsia for 12 years, underwent gastrojejunostomy for duodenal ulcer. After temporary improvement he relapsed, and 1½ years later the duodenum was found narrowed and the ulcer not healed. There was a jejunal ulcer right over the gastric opening, surrounded by induration, forming a mass the size of a child's fist, which had spread into the mesentery of the transverse colon and into the omentum. The duodenal ulcer was left alone, the jejunal ulcer was treated by excision of the anastomosis and by junctions as in the former case; also a segment of the transverse colon had to be excised and an end to end union made. Improvement followed, and for 1½ years he was on active military service. The dyspepsia then recommenced and he suffered from pneumonia and empyema. Presumably the duodenal ulcer had not healed.

Case III. A man at the age of 28 underwent gastroenterostomy for a gastric ulcer, Murphy's button being used. Four years later he presented an ulcer of the pylorus and upper part of the duodenum which had become adherent to the abdominal wall, to the liver, and to the pancreas. The anastomosis opening had almost closed. The adhesions were partly separated and a posterior gastrojejunostomy done afresh. A year later, a third laparotomy disclosed an ulcer of the descending loop of the jejunum 3 cm. below the gastroenterostomy opening. The whole of the affected area, including the jejunal ulcer and the gastrojejunostomy opening, was excised, and the operation completed as before. Four and a half years later the man was reported as having a good digestion, but he had become insane.

Case IV. A man aged 50, suffering from duodenal ulcer, was treated by gastrojejunostomy along with exclusion of the pylorus. A year and a half later he had a jejunal ulcer opposite the opening which had burrowed into the mesentery and set up an abscess the size of a fist. A free excision was followed by union as before; the wall of the abscess was cauterized. Four years later the patient was complaining of continued pain, acid eructations, and often vomited after dinner. He had to keep mainly to a fluid diet, but had not lost weight.

Case V. A man aged 33, suspected of incipient phthisis, had had gastrojejunostomy done, although there had been no sign of an ulcer. Gastric pain came on and increased; he had melaena, and a year after the anastomosis was found to have a jejunal ulcer which had burrowed into the mesentery. As there was no evidence that the man had ever had an ulcer, the gastrojejunostomy was undone, the jejunal ends being united end to end. This man gained 16 kilogrammes in the following four months and was able to serve on the lines of communication. He still had symptoms of hyperchloridia.

Case VI. A man aged 33 underwent gastrojejunostomy and pyloric exclusion for severe pyloric stenosis. He improved for a time and then developed signs of a jejunal ulcer, which was found to have extended from the region of the anastomosis into the pancreas and mesocolon. A wide excision was made, and three years later the patient was 6 kilogrammes heavier. If he took small meals he could eat anything and was free from pain.

Case VII. A man aged 55 had had gastroenterostomy and exclusion of the pylorus for a callous duodenal ulcer. A year later he had become reduced to a milk diet, and was found to have an ulcer in the descending loop of the jejunum, 2 cm. below the anastomosis, which had become adherent to the abdominal wall and to the colon. The jejunal ulcer was excised, the gastrojejunal anastomosis being left undisturbed. After some improvement, he relapsed, presumably from impairment of the pancreas, for he was relieved by pancreatic extract and by avoiding meat.

Case VIII. A man aged 44, much like the last, improved after the first operation, and went on military service for nine months. Then he relapsed, and a jejunal ulcer was excised along with a wedge of mesentery. A year later he had an attack of haematemesis, and had to keep to light food.

Case IX. A man aged 36, resembling the preceding, relapsed six months after the first operation. The jejunal ulcer was found in the descending loop, 6 cm. below the gastric opening. The affected segment of the jejunum was excised, and an end to end union made. The patient died suddenly the next day from pulmonary embolism. A post-mortem examination found that the duodenal ulcer had healed, so that this case differed from others in which the duodenal ulcer had either not healed or had recurred when the jejunal ulcer developed.

Case X. A man aged 40, after a similar exeprience to Case IX, continued to suffer from haematemesis after the second operation, and died on the fifth day. Then it was found that the original duodenal ulcer had healed, but the haematemesis which had followed the second operation for the jejunal ulcer, had come from a wide erosion of the cardiac end of the stomach.

Thus jejunal ulceration appears to be generally set up by the duodenal ulcer remaining unhealed, and in the two cases in which healing had occurred the jejunal ulcer appeared to be provoked by toxins from gastric erosions.

Freud discovered by X-ray examination that in five cases after gastrojejunostomy a peptic jejunal ulcer had formed, and had then ruptured into the transverse colon.

Clairmont and Hadjipetros, in four similar cases, performed extensive operations in order to separate the colon from the jejunum. One case died of pneumonia.

Clairmont advocated, when operating for jejunal ulcer and such-like cases, a raising of the third part of the duodenum so that it could be displaced towards the right. Anatomy books exaggerated the density of the connective tissue between the duodenum and the head of the pancreas and the spine. Upon drawing the commencement of the jejunum over to the right the plica duodenojejunalis in front, and the plica duodenomesocolica behind were put on the stretch, and could be divided without injuring the superior and inferior mesenteric blood-vessels. Then, by using swabs, the third part of the duodenum can be raised and displaced to the right from in front of the aorta and inferior vena cava. Care must be taken not to injure the left colic artery running into the raised mesocolon, nor must the stripping of the duodenum proceed so far as to injure the bile and pancreatic ducts. This mobilization will facilitate a duodenojejunal anastomosis and other operations and explorations.

**The relation of gastric and duodenal ulceration to cancer.** Two recent American communications express doubts as to the frequency with which simple ulcerations degenerate into cancer, and tend to revert to the old view that cancer generally begins as such. According to Ewing, cancer is widespread with extensive induration and uniform infiltration, an erosion with here and there excavations. Simple ulcers are circumscribed with smooth overhanging edges; there is, however, often a glandular hypertrophy with fibrosis of the submucosa which produces a resemblance to cancerous infiltration.

Willensky and Thelimer examined microscopical specimens of gastric ulceration. Thirty-nine specimens proved to be instances of simple chronic ulcer in accordance with the naked eye appearances. Seven specimens in which the appearance at the operation resembled carcimona, proved also to be simple ulcers. One was a specimen of simple ulceration, but there was a nodule of carcinoma at one margin. In cases of carcinoma so early that the lymphatic glands are not involved an excision carried 2 cm. beyond the ulcerated margin appeared to remove all the malignant disease.

There does not, however, appear to be any trustworthy means of distinguishing cancer when exposed at the operation, at least at a stage early enough to promise success after excision, except by the immediate examination under the microscope of a fresh section.

Troell reported on the fate of the cases diagnosed in the Stockholm Hospital as irremovable cancer of the stomach during the years 1907–14.

137 cases were diagnosed as cases of irremovable cancer and were treated by gastroenterostomy. Of these, 70 were reported upon later: 60 died within 1–35 months of cancer, 9 of them surviving more than a year. The average duration was 7·5 months. 7 died of cancer at an unknown date; 3 were alive and free from cancer 8 years, $7\frac{1}{2}$ years, and 6 years later respectively.

134 cases were diagnosed as cases of irremovable cancer of the stomach as the result of exploration, without anything further being done. 52 of these were reported upon later; 49 died within 1–35 months, 3 living

longer than a year; 1 died of cancer at an unknown date; 2 were alive $6\frac{3}{4}$ years after without a sign of cancer.

30 cases were diagnosed as inoperable cancer of the stomach without any exploration: 26 died within 1 to 26 months; 1 died 17 months later of tuberculosis; 3 were alive without any sign of cancer $8\frac{1}{2}$, $8\frac{1}{4}$, and $4\frac{1}{2}$ years later respectively.

Statistics from the same hospital of 90 cases of cancer of the stomach treated by excision concluded that the average duration of life after the excision was from 15–20 months, as compared with 7·5 months after gastroenterostomy.

The primary mortality among the cases of cancer was:

In the 25 per cent. submitted to excision, 19 per cent.
„ 38 „ „ „ gastrojejunostomy, 17 per cent.
„ 37 „ „ „ exploration, 16 per cent.

i e. an average primary mortality of about 18 per cent.

Thus in selected cases the mortality following the excision of the cancer did not greatly exceed those following the gastrojejunostomy.

Gastrojejunostomy when malignant disease is present is attended by more than double the mortality which follows the operation in cases of simple ulceration.

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# MALUNITED POTT'S OR DUPUYTREN'S FRACTURES AND DISLOCATIONS AT THE ANKLE

**Nomenclature.** There is in connexion with injuries at the ankle much confusion as to terminology. The common injury at the ankle is known to English surgeons by the name of Pott, suggested by his accident in 1756. French surgeons apply the name of Dupuytren to the common as well as to the exceptional and severer injury. Systematic descriptions include part of the subject under 'Dislocations' and part under 'Fractures'. Sir Astley Cooper and others spoke of the tibia as the bone dislocated from the astragalus and foot, which had this practical drawback, that it misdirected attention from the necessity of returning the astragalus and the rest of the foot into place. Before the introduction of examination by the X-rays, it was difficult to distinguish the slighter varieties of dislocation and fracture from sprains, and as to the severe injuries the descriptions, as well as the specimens in museums, have been in many cases drawn from instances of primary amputation. Such specimens are not necessarily examples of the condition existing in cases which just escape primary amputation. The common accident, called Pott's fracture, is characterized by the yielding of the structures on the inner side of the ankle, the internal lateral ligament, and the tip of the internal malleolus. This is followed by a fracture of the fibula just above the external malleolus. Whether by a continuation of the force causing the accident, or owing to the forcible contraction of the peronei muscles, and of the calf muscles through the tendo Achillis, the foot is everted into a position of valgus, and the astragalus and foot are drawn backwards so that the foot is in the position of equinus. The relative degree of valgus and equinus varies, but the peronei and calf muscles are unopposed, owing to the loss of resistance of the internal lateral ligament, as well as to the overstretched state of the tibialis posticus and the flexor longus hallucis. The original description by Pott is diffuse and vague, but is stereotyped by the drawing on the plate. The lower end of the tibia had perforated the skin, and the question of amputation was raised in consultation.

The primary idea of Dupuytren was a displacement of the foot upwards, so that the limb was actually shortened. His original description was from an old-standing case examined clinically, and he supposed that the accident was caused by a forcing apart of the tibia and fibula by a rupture of the interosseous ligaments, so that the astragalus was impacted between them. Such an accident was described by Fergusson and by Bryant; recently Millikeir has published an X-ray photograph. The museum specimens taken from primary amputation show a displacement upwards of the astragalus and foot, an exacerbation of the less severe injuries in which the fibula is fractured obliquely and comminuted, involving the external malleolus owing to the outer rim of the upper surface of the astragalus being forced upwards and backwards. There is along with this a separation of the lower fragment of the fibula from the tibia, due either to a rupture of the interosseous ligament or to the tearing away of the posterior edge of the articular surface of the tibia. But the fibula above the fracture remains attached to the tibia. The astragalus is thus displaced upwards external to and behind the lower end of the tibia, and it with the foot may be twisted on a vertical axis so that the toes point outwards to an angle of 45° or more from the middle vertical line. The comminuted lower fragment of the fibula with the external malleolus retains its apposition with the side of the astragalus, but by so much as the astragalus is rotated on its anteroposterior axis outwards, by so much does the fibular fragment protrude on the outer side. Not only may the internal malleolus be fractured, but it may include a portion of the tibia, and this inner fragment then tends to be displaced so as to lie under the articular surface of the tibia, in the gap left by the displacement of the astragalus. French surgeons also use the names of Boyer and Maisonneuve. Boyer described a case of displacement of the foot outwards without fracture of the fibula, the head of the fibula being separated from its articulation with the tibia and driven upwards. Maisonneuve laid stress upon a sign of fracture of the fibula, one thumb being placed on the tip of the external malleolus and the other thumb on the upper end of the lower fragment, by pressing alternately a rocking movement could be obtained.

**Frequency of malunion in France.** The Société de Chirurgie has had the subject under consideration on many occasions during a long series of years. Owing to an increased frequency of cases of malunion among soldiers there have been recently a number of discussions at meetings of the Société. This increased frequency may be explained by the exigencies of military service, but it may also be due in part to an ignoring of the prescriptions as to reduction long ago laid down by authorities.

In 1913 Chaput referred to the accidents causing a fracture of the malleoli with a dislocation of the foot outwards and backwards, which he called Dupuytren's fracture. Many cases were found malunited after taking off the plaster case, although supposed to have been reduced.

For the treatment of such malunion, three procedures had been practised.

(1) Tillaux had advised that the heel should be seized with one hand, the instep by the other, whilst the leg is held by an assistant. The foot is then flexed to a right angle and strongly turned inwards. The fallacy of such a method is that the luxation backwards is not reduced, only the displacement outwards.

(2) The way to reduce a backward dislocation is to place one hand behind the heel and the other in front of the leg, just as one takes off another's boot.

(3) A more forcible reduction is obtained by placing the heel upon a block of wood or upon the edge of a box and making pressure.

Houzel reported through Quénu the case of a non-commissioned officer in the artillery, aged 24, who was thrown off owing to the bursting of a shell, and was dragged by his horse with a foot in the stirrup for 200–300 metres. The foot was simply bandaged at the ambulance, and he was sent back to Paris. The day following the accident he was found to have a Dupuytren's fracture, with the foot displaced backwards. Under general anaesthesia the foot was stated to have been reduced; also the fractures noted by radiography. Two months later the foot was found to be in a position of marked valgus, being displaced outwards at an angle of 140° with the outer side of the leg. The ankle was then put in a plaster case for a further six weeks. The following deformities were noted by Houzel: the foot was in a position of marked valgus, but the displacement backwards had been reduced; the internal malleolus had been fractured at its base and dragged apart by the astragalus so as to be in line with the axis of the tibia. The external malleolus had been fractured obliquely, whilst the lower part had been divided into two; one fragment still connected with the astragalus, the other displaced upwards so that the tip was nearly on a level with the articular surface of the tibia. The pointed end of the upper fragment rested attached to the tibia. Between the lower end of the upper fragment and the rest of the malleolus was a space of 1 cm., into which bulged the outer rim of the astragalus.

Houzel divided the fibula with an osteotome obliquely, three fingersbreadth above the malleolus, and, after loosening the fragments including the inner malleolus, he wrenched the foot inwards and applied a plaster case. This was followed by massage.

Quénu saw the case nine months after the injury and six months after the osteotomy, when the conditions as above described were found to have undergone no improvement as the result of the osteotomy. Consequently the internal malleolar fragment and also the astragalus were removed. The external malleolar fragments were left, but a silver wire suture was inserted to fix the fibula to the cuboid in order to prevent displacement of the os calcis inwards. The foot was kept in plaster for 50 days. A year after the injury the foot was fixed at right angles to the leg, and the line of the crest of the tibia corresponded with the second metatarsal, whilst the sole was placed flat on the ground. There were slight movements of flexion and extension at the ankle without lateral movement. The displaced external malleolar fragments gave no trouble. With a little thicker sole to his boot he could walk several kilometres without fatigue.

Quénu said that in the course of the last forty years the subject had been frequently discussed in the Société de Chirurgie.

In 1880 the treatment most in favour was wrenching, or wrenching combined with re-fracture, which might be facilitated by using an osteoclast. In 1887 osteotomy received the chief support, osteotomy first of the fibula, and if that failed, then also of the tibia. The tibia might be simply divided or a wedge of bone excised. In 1898 a double osteotomy of the fibula, one section above and one through the external malleolus, was advocated, with an osteotomy of the tibia added. Partial atypical excision of the ankle was preferred by Lucas-Championnière in 1880, and cases were reported to the Société from time to time. Quénu had in 1907 directed attention in particular to the displacement consequent upon the separation of the fibula and tibia, which could be remedied by removing the astragalus.

By means of the X-rays it had become possible to form an exact idea of the extent of the fracture and of the displacements, and this had become an essential preliminary to the reduction by operation.

The cases might be divided into two classes:

(*a*) In which there is a backward displacement of the foot without lateral deviation. In this case the chief obstacle to the return of the astragalus into the tibiofibular mortise is the fractured internal malleolus, whilst the astragalus is impacted in the gap made by the separation of the tibia and fibula. In such a case it is necessary to get rid of the obstruction presented by the internal malleolus, which should be excised. This is better than attempts to loosen it and fix it in position. In addition, the fibula may be divided. But it is very likely best to excise the astragalus.

(*b*) The second class of injury is that to which Houzel's case belongs, in which there is not only displacement backwards, but deviation of the foot into a position of valgus. In such the lower end of the fibula and external malleolus are fractured obliquely and the lower malleolar fragment is shifted upwards so as to override the end of the shaft of the fibula. Also, instead of the rupture of the interosseous ligament, the posterior margin of the tibia is torn off. In such cases the essential treatment is astragalectomy.

Dujarier had operated on four cases of badly united Dupuytren's fracture, but had not kept the patients under observation after recovery.

Case I. A mason aged 28 had injured himself a month before, but was at first treated for a sprained ankle. The radiograph showed a Dupuytren's fracture with the astragalus and foot displaced backwards and the fibula fractured 7 cm. above the tip of the malleolus. The lower fragment with the malleolus had been displaced upwards and backwards so as to lie behind the tibia, from which the internal malleolus was detached. The man could not walk. An incision was made along the posterior and inner border of the tibia which curved forwards at the tip of the internal malleolus. The detached internal malleolus was raised but could not be reduced into place. Thereupon a horizontal slice 5 mm. thick was removed from the lower end of the tibia, after which, by applying force, the fragments were reduced. The internal malleolus then came into normal apposition with the tibia and with the astragalus. The wound was closed without drainage and a plaster case applied. The patient was lost sight of after leaving hospital.

Case II. A woman aged 47 had sustained a Dupuytren's fracture two months previously: the astragalus and foot were displaced backwards, but there was no lateral deviation.

Under spinal anaesthesia with stovain, a curved incision was made round the lower end of the fibula and the astragalus was excised piecemeal. The internal malleolus and part of the horizontal articular surface of the tibia had been detached, displaced backwards, and there fixed. This fragment could not be freed and brought forward until after the removal by rongeur forceps of the anterior border of the articulating surface, which constituted an obstructing ridge. The wound was united without drainage and firmly bandaged, but not in plaster. When leaving hospital the patient could walk, but with difficulty.

Case III. A woman aged 49, eight months before, as the result of a false step, sustained a Dupuytren's fracture. The foot was subluxated outwards and a little backwards so that it was outside the axis of the limb and the crest of the tibia was in line with the inner border of the great toe. The internal malleolus was prominent and the sole of the foot looked outwards. Walking caused pain in the instep and outer part of the foot, which was swollen by oedema.

Under spinal anaesthesia by stovain, the fibula was exposed and divided obliquely at the level of the fracture. Then a curved incision like a capital J was made round the internal malleolus, which was loosened from the tibia, and scar tissue was excised from between the tibia and the astragalus. The bones were very friable, and by means of a lever inserted between the astragalus and tibia, with much difficulty, the displacement outwards of the foot was overcorrected so as to assume a position of varus. The two incisions were united without drainage and a plaster case applied, in order to maintain the varus position with the heel brought well forward. The plaster was reapplied until after a month, when massage was adopted and the patient began to move about with a stick. Six weeks after the operation the patient could walk without a stick, she could bend the knee, and place the sole of the foot flat on the ground. A boot was ordered with the sole thicker on the inner side.

Case IV. A man aged 48 sustained a Dupuytren's fracture and underwent two operations for its replacement. Eight months later he presented a marked flat foot with rotation of the great toe inwards. Under spinal anaesthesia both the tibia and the fibula were divided above the malleoli by an osteotome, after which the valgus and the internal rotation of the great toe could be corrected. The result was that the axis of the limb was brought into the normal line with the astragalus, and the patient was able to walk fairly well.

The foregoing cases are instances of three methods: the replacement of the fragments through an open incision, which is attended with great difficulty; astragalectomy, which is especially indicated when the foot is displaced backwards; and osteotomy above the malleoli, which allows of the correction of the valgus.

Delbet had in early days taught that recent cases of Dupuytren's fracture could be readily reduced and malunion prevented. Failing in that, the malunion could be remedied by linear transverse osteotomy of the tibia and fibula. But he had been forced to change his opinion. For old-standing cases he had excised the internal malleolus and then divided the callus, fixing the fragments, especially of the external malleolus. In this way the valgus and the displacement backwards could be remedied, but there was apt to persist a condition of equinus. He had for this removed ossified callus from the anterior border of the tibia, and also divided the tendo Achillis. All this formed a complicated procedure and the results were in some cases only poor. He had therefore in his last case followed Quénu and removed the astragalus. But the principal thing was to reduce properly the Dupuytren's fracture whilst still recent.

Tuffier had generally employed for the simpler cases osteotomy above the line of fracture. He strongly opposed attacking the callus at the site of fracture; in order to complete reduction by this method much destruction is done, and the results are generally deplorable. When the deformity is very marked, as in a case operated upon a short time ago, astragalectomy was the most satisfactory procedure.

Lecène reported six cases:

(1) A male aged 50 was treated immediately by fixation in plaster and eleven weeks later was found to have a marked displacement of the foot backwards, so that the continuation of the long axis of the tibia passed in front of the head of the astragalus, but the lateral deviation was not great. The posterior border of the tibia was resting on the neck of the astragalus. The fibula was fractured 3 cm. above the external malleolus, and the internal malleolus had been torn off. An incision was made along the anterior border of the fibula as far as the calcaneocuboid joint. The lower fragment of the fibula was excised, for it had been so displaced as to be almost horizontal. Then with a saw the upper surface of the astragalus and the lower surface of the tibia were removed, when the foot could be readily reduced into place. It was fixed into position by a silver wire through the tibia and astragalus, holding the foot at a right angle to the leg. The plaster was applied for a month, after which the patient begun to walk with the foot ankylosed at a right angle. A year later he could walk readily without trouble and the foot remained in the above-mentioned position.

(2) A woman aged 47 had been treated by plaster for six weeks after the fracture, but the patient never regained power of walking for more than 200 to 300 m., and that only with the aid of two sticks.

Two years after the accident the foot was found dislocated backwards so far that the anterior border of the tibia was at the level of the joint between the scaphoid and internal cuneiform. The fibula had been fractured above the external malleolus and the lower fragment had been turned so as to be almost horizontal. The internal malleolus had not been torn off, but the posterior border of the tibia had separated, around which had formed an exuberant mass of callus united with the astragalus.

The incision was the same as in the previous case, together with the removal of the lower fragment of the fibula. The astragalus and the callus behind the tibia were next removed, but the internal malleolus was preserved. The foot could then be reduced into good position. It was kept fixed in plaster for five weeks, after which the patient began to walk with a stick. Six months later the patient expressed herself as most pleased; she could walk without a stick, go up and down stairs readily, and walk about her garden without trouble.

(3) A woman aged 53 was treated with the limb in plaster for five weeks. After that she could not get about, even with a stick, because her ankle gave way on the inner side. Five months after the accident the foot was found in extreme valgus, there was a fracture 2–3 cm. above the external malleolus, and the axis of the tibia was in line with the neck of the astragalus. The internal malleolus was torn off. An incision was made along the posterior border of the fibula ending over the outer margin of the astragalus. The fibrous union of the fibula was divided with a knife. The astragalus, the head of which was in contact with the anterior border of the lower end of the tibia, was excised. The fibrous union of the internal malleolus was divided sufficiently to replace it. Then the lower fragment of the fibula was fixed to the upper by catgut sutures. The foot was placed in an overcorrected position of varus. Seven months later the patient was walking well, with the foot in good position and some slight movements of flexion and extension at the ankle.

(4) A man aged 45 was thrown and received a dislocation of the right shoulder and a fracture of the left external malleolus with a marked dislocation of the foot backwards. The shoulder dislocation was reduced and the foot put in plaster. Five weeks later an X-ray photograph showed the displacement backwards of the foot so that the anterior border of the tibia was in line with the astragalo-scaphoid joint. The fracture of the fibula was a short distance above the malleolus, but the internal malleolus was not fractured. There was plainly shown a wedge-shaped fragment detached from the posterior border of the lower end of the tibia. An incision was made along the anterior border of the fibula, the fibrous union between the fragments divided, and following this the fragment of the posterior border of the tibia removed. Whilst the foot could now be reduced, the dislocation tended to recur owing to the loss of the posterior margin of the tibia. Hence astragalectomy was done. He was treated by plaster for a month and then began to walk with a stick. Three months after the operation the foot was in good position; he could walk without trouble, the foot being at right angles with the leg, and there were slight movements of flexion and extension.

(5) A soldier aged 38, four months after the accident had flat foot, and the X-ray showed a fracture of the fibula, about 8 cm. above the external malleolus, the internal malleolus had been broken off and turned under the tibia. The fibula was widely separated, and the foot was dislocated backwards so that its heel was in contact with the posterior surface of the tibia. The operation was similar to the previous case, including the removal of the astragalus. Three months later the man could march well without a stick.

(6) A soldier aged 38, who had been treated by splints and massage, was found three and a half months after the accident with marked valgus and dislocation of the foot backwards. The anterior border of the lower end of the tibia corresponded with the astragalo-scaphoid joint. The fibula was fractured 4–5 cm. above the external malleolus. The internal malleolus had been torn off.

After an operation similar to the foregoing cases, the man recovered so that three months after the operation he had a firm foot and walked well without a stick.

Savariaud regarded the reduction of such fractures, when recent, as an easy matter under spinal anaesthesia. The cases of malunion he had undertaken had been reduced by dividing and excising the fibrous unions, and he had attained a good result, especially because he had preserved the two malleoli. But in his last case he had not been so successful; the foot remained rigid with a pronounced prominence of the internal malleolus.

Robineau had operated on two soldiers injured during the war. In the first he had aimed to divide the fibrous unions, but had to extend this to an irregular excision. The result was a good position, but the patient suffered much pain in the leg and instep. In the second instance suppuration followed, and the displacement recurred, an attempt during the suppuration to lever the astragalus back into position failed, and so the astragalus was removed. After prolonged suppuration for three months some sequestra were removed from the tibia. After this healing set in with the foot in good position, but the man was transferred before this was complete.

Cuneo had performed astragalectomy for malunion following a Dupuytren's fracture; but the patient, discontented with the result, threatened an action at law and claimed damages. The starting-point of the claim was the statement by some surgeons that removal of the astragalus was never indicated in such cases. He was glad to find that a number of the society's members held just the opposite view.

Reynier held that for the simpler cases osteotomy of the fibula permitted of the reduction of the foot. For the more complicated cases the removal of callus is necessary. As for astragalectomy, it succeeded in some cases but not in all. A man met with a severe motor accident, sustaining a Dupuytren's fracture on each side. Malunion occurred so that he could only move with crutches, resting on his toes. Reynier removed the astragalus on each side. The feet were thus brought into good position, but the functional effect was not brilliant: the patient walked badly and that with two sticks.

Fredet had had a good result after osteotomy of the fibula in a case in which there was marked valgus.

Auvray had in three cases adopted osteotomy of both fibula and tibia in an oblique line so as to favour reduction. He was himself content with the immediate result, but had not informed himself as to the later results.

Mauclaire was inclined to believe that the external deviation of the foot often recurred when the patient began to walk, although at the time of the accident the fracture had been reduced. He had operated on three cases of valgus following fracture of both tibia and fibula by osteotomy of the tibia. He had removed the astragalus in one case in which there was simply a dislocation of the foot backwards. In two cases he had divided the fibula at the junction of the external malleolus with the shaft when the deformity was limited to a valgus position. The results had been very good. In two cases it was necessary in addition to divide the base of the internal malleolus. In four cases more was necessary; after dividing the external malleolus and the internal malleolus, the astragalus was removed in three cases, and the astragalus and a posterior fragment of the tibia in a fourth case. There was a good result ultimately in the three former, but recovery was slow; in the last case, at the end of a year walking was painful and there was some valgus. In the treatment after the operation active massage was employed with passive movements, even under a general anaesthetic when otherwise too painful.

Souligoux recalled a case of an atypical excision of the ankle which he had exhibited after recovery to the Société in 1913. The man, two months after the accident, had the foot in marked equinus, it being dislocated backwards and outwards, so that he could only walk on his toes, and he demanded amputation. The X-ray showed a large fragment detached from the back of the tibia, and in between was fixed the posterior margin of the astragalus. The anterior border of the tibia was in contact with the head of the astragalus, entirely preventing the foot from being brought to a right angle with the leg. Around all the fracture and extending up the fibula were signs of ossifying callus. On laying open the joint with the object of removing the astragalus, so much fibrous and ossifying callus was met with that it was decided to gouge away the under surface of the tibia until the foot could be brought up to a right angle. When exhibited to the Société two years after the operation the man walked perfectly, the foot was in good position, and there was some movement of flexion and extension between the tibia and the astragalus.

At the following meeting of the Société Delbet returned to the subject of astragalectomy, which he had done, particularly with the object of relieving the equinus. He had just seen his patient again. The functional result was not good, for the patient tended to walk with the foot everted. The X-rays show a large fragment detached from the posterior border of the tibia against which the astragalus had rested. Delbet suspected his patient of aiming at recovering compensation from the doctor who had first treated him. The case, however, showed that astragalectomy was successful, but only in certain cases.

In another case marked by valgus and a separation of the lower ends of the tibia and fibula; the fracture of the fibula was 13 cm. above the tip of the external malleolus. Delbet began by removing the callus around the internal malleolus, then that separating the tibia from the fibula; he next gouged away the under surface of the tibia and removed the fragment detached from the back of the tibia. This freed the inner aspect of the fibula for the length of 6 cm. By this means the foot could be brought forward so that the astragalus was placed between the two malleoli, and the result was very much better than if the astragalus had been removed.

Auvray reported the late result in a patient upon whom he had operated in 1915 by osteotomy of both malleoli. Before that, walking had been almost impossible. The patient now had written to say that in shoes without heels the sole of the foot rested flat on the ground, but with heels this was incomplete. She could walk for a time, but after two or three hours on her feet the foot swelled and the leg felt heavy; walking was then painful. Whilst she did not need a stick for a short distance, she used one for a longer walk on the road. In spite of this limitation, she expressed herself as well pleased, for without the operation she would have been laid up entirely. The result is not ideal, but no more would have been got from an astragalectomy.

Another case, a soldier, had fallen downstairs on December 5, 1917. Auvray found him in hospital with the fracture malunited, the foot being turned outwards and displaced backwards, so that walking was much hindered. Osteotomy through both malleoli was done on Feb. 20, 1918, followed by deep sutures through the periarticular fibres and superficial ones for the skin. The deformity was well corrected as the result of this operation; the foot could be placed flat on the ground; the patient could walk without a stick, but not very far; he could ride a bicycle and had resumed his former occupation. The leg was wasted and the foot swollen over the ankle; the patient had pain at change of weather and when fatigued. There was no movement of the ankle-joint. But he was quite satisfied with the result.

**Summary.** The number of cases brought before the Société de Chirurgie of malunion after injuries at the ankle is impressive. Nearly all were cases classed by English surgeons under the title of Pott's fracture. An X-ray examination both before and after reduction, at any rate after manipulation for reduction, before the photograph is obscured by plaster of Paris, is of great importance. By it may be recognized the separation of the posterior margin of the articulation of the tibia, which particularly favours a recurrence of the dislocation of the astragalus backwards. The essential displacement of the astragalus with the rest of the foot is by rotation outwards into a position of valgus, and a rotation backwards into one of equinus—the relative degree of valgus and equinus varying. It is quite exceptional in those cases which just escape primary amputation for there to be an additional displacement of the astragalus with the foot upwards. The manipulation in order to reduce must be such that the deformity shall be a little overcorrected, the foot a little turned into a position of slight varus, and the heel brought so forward that the foot forms with the leg a right angle or somewhat less. This can be done by the operator placing one hand behind the heel whilst the other makes counter-pressure on the lower third of the leg. The reduction is then opposed by the spasm of the calf and peronei muscles, which shortly after the accident can be overcome by anaesthesia with the knee flexed.

But there are illustrations in French surgical works which depict the operator with one hand on the instep and the other on the heel; this suggests extension in the long axis of the limb, which, barring exceptional cases, is not wanted. The same erroneous notion is suggested by Delbet's method. Whilst the ankle is being put up in plaster of Paris, extension by a loop round it connected with a cord and weight is kept up until the plaster has dried. In order to overcome the spasm of the calf and peronei muscles, the patient should as a rule be fully anaesthetized. This is most certainly accomplished by a general anaesthetic, and the substitution of spinal or local anaesthesia appears of doubtful expediency, owing to the probability that the muscles will not be fully relaxed.

A few hours after the accident a rigidity of the muscles sets in, which often cannot be completely overcome even by deep general anaesthesia. Then the division of the tendo Achillis, strongly recommended in former days, e.g. by Bryant and Lucas-Championnière, will allow of the reduction and slight overcorrection of the deformity above alluded to.

The hurried wrapping up in plaster of Paris casing obscures an X-ray examination as well as one by the naked eye. Moreover, the plaster tends to soften and yield, so that, unless the deformity has been overcorrected, a relapse may readily occur. The particular casing much used in France, two lateral strips with circular bands below the knee and around the ankle, tends to yield even more readily than a complete case.

Lucas-Championnière's recommendation of early massage had the advantage that the foot could be inspected daily.

But the slight overcorrection has to be kept up for a long time, until the internal lateral ligament and the overstretched tibialis posticus and flexor longus hallucis have recovered. This is not completed for months; meanwhile the patient's weight, bearing on the weakened inner side of the ankle, together with the unopposed action of the calf and peronei muscles, may reproduce a very marked equinovalgus deformity. Whether by boots, or when standing and walking, weight must be thrown upon the outer side of the foot so long as the structures on the inner side remain weak. When the deformity owing to malunion has become established, the results of operative interference are likely to be unsatisfactory, owing to the weakening of the outer as well as the inner side of the ankle. The normal mortise, permitting only of flexion and extension of the astragalus, is not restored. For the slighter cases described by the French surgeons it may be questioned whether the restoration of the mortise would not have been more nearly accomplished if the tendo Achillis and the peronei tendons had been first divided and then the foot wrenched inwards and brought forward.

The excision of the astragalus, or that with the removal of callus and fragments of the internal malleolus and posterior border of the tibia, was adopted in some cases, in others an osteotomy of the fibula or tibia or both. As to the former procedure, the result to be aimed at must be an ankylosis, so that the sole of the foot is flat on the ground. Movement between the tibia and os calcis after astragalectomy must be unsatisfactory owing to the tendency to lateral movement. Osteotomy can only be satisfactory when the foot is already ankylosed in a correct position, and the line of weight can be made to pass through the long axis of the tibia.

In the exceptional cases in which the astragalus is really displaced upwards, the first question is the saving of the limb from amputation, and next the diagnosis of the injury by aid of the X-rays. Reduction will then only take a third place, and be carried out when it appears that the circulation in the foot is sufficient. Fergusson and Bryant found the astragalus firmly wedged between the tibia and fibula, but the foot was in such a good position that the sole could be placed flat on the ground. The displacement upwards of the astragalus was left unreduced, and a firm useful ankle was the result. As for the cases illustrated by museum specimens, in which there is a comminuted fracture of the fibula, a displacement of the astragalus upwards and backwards external to the tibia, with the internal malleolus lying under the tibia, it would seem that a trial should be made of gentle reduction, after tenotomy of the tendo Achillis. The circulation in the foot may be endangered by extensive operative interference.

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# THE EXTRAPYRAMIDAL SYMPTOM COMPLEX

In the text-books of medicine, that clinical concept 'the upper motor neurone lesion' still remains a synonym for disease involving the pyramidal system of fibres, and conditions such as paralysis agitans are yet found classed among the neuroses, while phenomena like tremor, athetoid, and choreiform movements are dealt with merely as symptoms found in certain clinical entities, and no attempt at their correlation into any body of physiological-pathological theory is to be found.

Till recently many of the reflex phenomena of spastic paralysis were similarly regarded, until the application to clinical neurology of Sherrington's fundamental researches on the nervous system revealed in what were previously but empirical diagnostic criteria, such for example as the 'extensor plantar response', the manifestation of co-ordinating reflex mechanisms unmasked by the processes of disease.

Since the full recognition, however, of the complete symptom complex of pyramidal tract lesions, comprehending, as this does, loss of voluntary power, the appearance of involuntary associated movements, hypertonicity of specific characters and selective incidence, increase of the facility of the tendon-jerks, abolition of purely cutaneous reflexes, the replacement of the normal plantarflexor toe response by the dorsiflexor, or Babinski, toe response, and finally, the appearance of the general flexion reflex of the lower limb, of which the Babinski plantar reflex is now known to be an integral part, the conception of an extrapyramidal motor symptom complex has become possible, and has, indeed, become the subject of a rapidly growing literature within the last few years.

The investigation of certain motor diseases in which all these characteristic signs of pyramidal tract lesion have been lacking has indicated the existence of motor mechanisms in the central nervous system distinct in identity and function from the pyramidal system, and has led to the conception of 'extrapyramidal motor diseases'.

Of these, paralysis agitans may perhaps be regarded as the clinical prototype, and while the characteristics of this disease have long been known, it is probably very largely due to the appearance in 1912 of S. A. K. Wilson's striking paper on 'progressive lenticular degeneration' that we owe the general recognition of the physiological significance of this group of diseases, and that the extrapyramidal motor symptom complex has taken its place among the current coin of clinical neurology.

It is clear that both in those disturbances of motility associated with lesions of the cerebellum and its connexions on the one hand, and in those found in such diseases as paralysis agitans and in certain midbrain and basal ganglia lesions on the other, pyramidal tract defect symptoms are, in pure cases, absent. We have, therefore, in effect, two large clinical groups of cases with extrapyramidal motor disturbances; (*a*) the cerebellar group characterized by atonia, asthenia, and by ataxy with its various clinical manifestations, and (*b*) a group characterized by the presence of a peculiar muscular rigidity with a tendency to the adoption of fixed attitudes, and eventually to the formation of contractures, sometimes dysphagia and dysarthria, and involuntary movements of the tremor type. Less commonly athetosis occurs. Slight paresis, but never true paralysis, is also the rule.

This symptom complex may be found in conditions differing aetiologically, and in the predominance, or absence, of one or other component of the syndrome. Nevertheless, in spite of marked individual differences, such cases possess in common certain negative and positive features clearly marking them out as belonging to the group.

Finally, it must be added, in certain members of the group there are peculiar associated visceral changes, such as hepatic cirrhosis, enlargement of the spleen, and pigmentation of the cornea. They may also be accompanied by psychical disturbances.

This second group it is the purpose of the present brief review to discuss, and before describing the clinical conditions in which the symptom complex may be seen, a short analysis of the component symptoms is necessary.

The **paresis** is never profound, it affects all the skeletal muscles equally, and is marked by an extreme readiness of fatigue.

The **rigidity** differs fundamentally from the spastic element of pyramidal tract lesions, and for this reason the words rigidity and spasticity should always be used as indicating distinct conditions and not as synonymous; the term 'spasticity' being confined to the case of pyramidal tract lesions.

For an appreciation of this difference it is essential to have clear ideas as to the nature of normal muscle tone. It has been shown by Sherrington that tone is a purposive reflex act arising in the deep afferents (proprioceptors) of the tonic muscles. Like other reflexes, it exhibits reciprocal innervation, and the antagonists of the tonic muscles do not show tone. The purpose of tone is the maintenance of posture, and we find accordingly that the extensor or 'antigravity' set of muscles in such a quadruped as the cat, and these muscles alone, are the seat of tone. In an animal such as the frog, whose posture is one of flexion, i.e. of squatting, the postural tone is flexor. There is abundant evidence (Walshe) that in man, similarly, tone has a selective incidence in the extensors of the leg and the flexors of the upper limb.

Now although this conception finds acceptation in physiology, it has scarcely yet penetrated clinical neurology, in which the tone of skeletal muscles is still regarded as diffuse in incidence and doubtful in meaning, and it must be borne in mind that practically all current hypotheses, and these are numerous, of the origin and cause of rigidity and spasticity are based upon obsolete conceptions of muscle tone. However, it is clear that to the understanding of these phenomena a lucid idea of the origin, seat, and purpose of normal tone is an essential preliminary. Armed with this, it becomes apparent that the spasticity of pyramidal lesions is a true hypertonus, showing unmistakably in its source, selective incidence, and characteristics a complete accord with this view of its nature (Walshe).

The rigidity of the extrapyramidal syndrome is a totally different phenomenon, the physiology of which has yet to be elucidated. It is diffuse in incidence, affecting agonists and antagonists equally (Wilson, Strümpell). It is not increased by sudden passive stretching of the muscles, it produces a tendency to the adoption of peculiar 'contracture attitudes' (Wilson), and these finally lead to myogenic contracture. All muscle movements are slow and of minimal excursion, hence the mask-like facies, the general immobility, the dysphagia, and the dysarthria. In short, it produces the Parkinsonian picture, in contrast to that of true spasticity such as we may see in a residual hemiplegia. The question of the source of this rigidity will be discussed later.

Certain involuntary movements complete the nervous side of the picture. These are usually of the **tremor** variety; rhythmical tremor of varying rate and amplitude in different instances and consisting in the alternate contraction of a group of muscles and of its antagonists. That of paralysis agitans is the best-known example, though in certain of the clinical entities included in the group the tremor is coarser and predominates in different muscle groups.

Of extrapyramidal origin, also, is **athetosis**, which has been recorded in some cases of the group. In one form of cerebral diplegia, double athetosis is the predominant motor defect, and in this instance appears to be associated with a bilateral lesion of the lenticular nucleus (Oppenheim and Vogt).

In the clinical picture under discussion it is not, however, a marked or frequent feature, though of allied origin.

This brief and necessarily inadequate analysis of the symptom complex brings us to the fact that Strümpell, who has done much to elaborate it, has suggested for it the name of the 'amyostatic symptom complex', because he regards the cardinal symptoms, rigidity and tremor, as being due to a constant irritation ('Reizzustand') of the centres governing the static or fixating, i. e. the posturally functioning, muscles. According to the nature of this maintained stimulus of unspecified source and cause, rigidity, tremor, or athetosis results. Now 'it is difficult to conceive of a lesion remaining irritative for years, yet we know that involuntary movements may persist indefinitely' (Wilson), and therefore just as this theory, applied years ago to account for the origin of spasticity in pyramidal lesions, has long been regarded as untenable, so must it be in this connexion: while from what has been said earlier of the characters of tone in muscle it is clear that the rigidity in question cannot have arisen as a disturbance of the reflex tonic postural function.

It may be appropriate, therefore, in introducing the phrase 'amyostatic symptom complex' into the English neurological literature, to present also its dubious pedigree, lest the fatal allurement of an attractive phrase should lead to the misfortune of its general adoption in this country.

Of the main clinical types in the extrapyramidal symptom complex, paralysis agitans needs no description here; other diseases of the group are, however, of infrequent occurrence and call for brief notice.

Westphal (1883), and later Strümpell, described under the name 'pseudosclerosis' a familial disease of early life characterized by diffuse rigidity of the musculature, disturbances of speech and swallowing, tremor, and psychical disturbances. Later, a peculiar pigmentation of the cornea was noted to be a constant feature, while more recently hepatic cirrhosis and splenic enlargement, and occasionally a lesion involving the corpus striatum, have been recorded. More often no nervous lesion was found. The term 'pseudosclerosis' was based upon a supposed likeness to disseminated sclerosis that more adequate knowledge of the symptomatology of pyramidal tract lesions has dissipated.

In 1912, in a comprehensive paper, S. A. K. Wilson described a series of cases occurring during early life, and of familial incidence, characterized by generalized muscular rigidity, tremor, dysphagia, dysarthria, emotionalism, and a tendency to contracture formation. A psychical element was also present. The constant post-mortem finding was bilateral degeneration of the lenticular nucleus and hepatic cirrhosis. Pyramidal signs were absent. In discussing this interesting condition, Wilson drew attention to its physiological significance as an extrapyramidal motor disease, and he elaborated a syndrome of the corpus striatum.

It has been widely stated in Germany that progressive lenticular degeneration, as Wilson has termed the disease, and pseudosclerosis are identical. This view is based upon a retrospective survey of previously published cases (Strümpell), and has, therefore, more of the nature of wisdom after the event than of actual observation.

Since this date very numerous cases presenting certain of the cardinal symptoms—nervous and visceral—of the disease have been recorded on the continent and in America, and Strümpell has summarized the situation in regard to the group as follows: The extrapyramidal symptom complex may be found in diseases differing widely in aetiology, but closely allied in their pathological-anatomical basis, and these may be classified as under:

(1) Juvenile familial forms: pseudosclerosis, progressive lenticular degeneration, juvenile paralysis agitans. In addition to rigidity, paresis, and tremor, these show dysarthria, dysphagia, abnormal attitudes and contracture. Psychical symptoms and the visceral changes detailed above are also found.

(2) Non-familial forms occurring in later life; paralysis agitans with and without tremor, and Förster's 'arteriosclerotic muscular rigidity'. These show rigidity and tremor, without marked speech or swallowing defects, and there are no visceral changes.

In both groups a lesion of the corpus striatum appears to be the essential pathological basis of the nervous symptoms. It is in Wilson's series only that a satisfactory pathological anatomy has been established, and in these the lesion consisted in a pure degeneration of the lenticular nuclei and of certain short fibre systems in connexion with these; notably the ansa lenticularis. This, Wilson concludes, leads to a defective efflux from the lenticular nucleus along a descending extrapyramidal path.

But it is doubtful whether this correlation of lesion with symptoms, unusually clear as this is, yet justifies any final conclusions as to the normal functions of the corpus striatum, for the localization of function in the brain is a far more intricate problem than the localization of symptoms.

The basis of the association of nervous with visceral lesion remains obscure, the suggestion being that in the juvenile forms the diseased liver produces a toxin having a selective action on the corpus striatum (Wilson).

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F. M. R. W.

# RECENT WORK ON THE BACTERIOLOGY OF THE 'PROTEUS' GROUP

There has always been an element of confusion ever since Hauser (1885) described three types of bacilli which he isolated from putrefying fluids, and which he called *Proteus vulgaris*, *P. mirabilis*, and *P. zenkeri*. The chief differential point was their behaviour in gelatin, the two former producing rapid liquefaction, whereas the last was a non-liquefier. All possessed, although in varying degree, the capacity to produce 'swarming islands', in 5 per cent. gelatin, leading to alterations in the shape of the colonies, an appearance which led to the name of 'Proteus'. At a later period (1892) Hauser withdrew slightly from his former position and, while regarding *Proteus vulgaris* as the type of the genus, considered *P. mirabilis* and *P. zenkeri* as physiological varieties. Before Hauser's publication Kurth (1883) had isolated from the intestine of fowls the remarkable *B. zopfii*, and Kruse, Klieneberger, and others regarded it as closely allied to *P. zenkeri*. Wenner and Rettger (1919) have now gone further and state that the two organisms are identical, and they suggest that they should be classified under the generic name of *Zopfias*, the *Proteus* group being thus reduced to two. They have made a systematic study of the *Proteus* group and based their conclusions on a study of 84 strains, 58 of which were obtained from different laboratories, while 26 were isolated by themselves. These organisms have been cultivated by various bacteriologists from soil, water, sewage, air, and from the intestine, although, seemingly, but rarely in health. Since the time of Hauser, *Proteus* has been regarded as a typical putrefying microbe. The main bacteriological features of the *Proteus* group are that the bacilli are coli-like in form, Gram-negative, and forming neither spores nor capsules. They are highly motile and liquefy gelatin, although this latter property may be lost. When inoculated into the condensation water of sloped agar tubes they rapidly spread over the entire surface of the medium. For isolation, Wenner and Rettger take advantage of this fact and transfer the original material directly to the condensation water of moist agar slopes, little effort being subsequently required to obtain pure growths on account of the *Proteus* bacteria overspreading the whole surface and leaving the associated micro-organisms behind. They tested 73 strains on gelatin and found rapid liquefaction by all except three. Litmus milk underwent coagulation and digestion. Wenner and Rettger agree with Stewart and others that glucose, laevulose, galactose, sucrose, and glycerol are fermented, while lactose is not altered.

It may, however, be pointed out that C. G. L. Wolf, in his careful analyses, has clearly shown that some strains at any rate cause lactose to disappear to the extent of 16 per cent. in 144 hours, so that, although *P. vulgaris* may not be a lactose fermenter in the ordinary laboratory sense, it has unquestionably this power when the action is extended to several days. The action on maltose is variously given by different writers. Horowitz observed fermentation with 23 out of 24 strains tested, while Stewart had only one positive fermenter in his 29 strains. Wenner and Rettger had 25 acid and gas producers in 73 strains tested, and they noted a definite correlation between the property of attacking maltose and the rapidity with which sucrose was fermented with gas fermentation, for all the strains which fermented maltose with acid and gas production also fermented sucrose rapidly, while all those which failed to attack maltose showed a delayed reaction with sucrose, gas and acid being observed only after eight to nine days. On the basis of this differentiation they suggest that the maltose fermenters should be classified as *P. vulgaris*, the term *P. mirabilis* being applied to those which have no action on maltose.

It is generally alleged that indol is abundantly produced from proteins during the growth of *Proteus*. In 1906 Steensma studied several strains which failed to produce indol, and Stewart found only one indol-former in 29 strains tested. Horowitz tested 24 strains, and found seven indol-formers, Berthelot 61 strains with 24 indol-formers, and in 73 strains tested by Wenner and Rettger only 4 showed no indol. In 33 the indol formation was marked and in 36 it was slight. C. G. L. Wolf incubated 10 *Proteus* strains in tryptic broth for 48 hours, subsequently testing for indol by the usual rosindol test with paradimethylaminobenzaldehyde and by Nelson's vanillin test, and obtained no positive indol formation. The presence or absence of indol has been utilized by van Loghem and Loghem-Pouw (1912) to subdivide *Proteus* into two groups, viz. *B. proteus-indologenes* and *B. proteus-anindologenes*, the latter being first isolated from the urine of a glycosuric patient with pneumaturia. These authors allege that apart from the indol reaction these races can be distinguished serologically, a view also maintained by Groot.

It has generally been believed that *Proteus* is endowed with great proteolytic properties, and indeed is the prototype of a putrefying microbe. This impression is intensified by the fact that it rapidly liquefies gelatin, although Wolf has pointed out that this feature by no means indicates great proteolytic properties. In the last few years the prominent position assigned to *Proteus* as an important agent in putrefaction has been assailed by Rettger and others, and it must be admitted that what ability it has is small compared with several of the sporing anaerobic bacilli, e.g. *B. sporogenes*. In his elaborate analyses C. G. L. Wolf shows that when grown on various media *Proteus* does not exhibit any of the qualities of a putrefactive organism. In common with other observers, he noted that it contains a powerful urea-splitting ferment, being capable of transforming 45 per cent. of the total nitrogen of urine into ammonia.

**Differentiation by serological tests.** As long ago as 1908 Klieneberger made a systematic attempt to differentiate different races of *Proteus* by means of agglutination, and he made out that whereas normal human serum agglutinated *P. zenkeri* and what he calls *P. zopfii* to a considerable titre it had little effect on *P. vulgaris* or *P. mirabilis*. An immune serum prepared from pathogenic races of *P. vulgaris* agglutinated both homologous and heterologous races of *P. vulgaris.* An immune serum prepared by injection of *P. vulgaris* isolated from putrid fluid agglutinated the homologous but had little effect on heterologous strains.

Cantu, who worked in Metchnikoff's laboratory, prepared nine different *Proteus* immune sera. In dilutions above 1 : 10 only the homologous strain was affected, so that the method was not considered of much value.

As mentioned above, van Loghem and Groot claimed that the indologenous and anindologenous strains of *Proteus* were also distinct serologically.

Horowitz, testing a large number of strains, found they fell into five serological groups, which for the most part were also distinct as regards their chemical fermentations.

Wenner and Rettger prepared seven immune sera from as many strains of *Proteus,* and found that with one exception, all the sera agglutinated strains other than those used in their preparation. Nineteen strains were not agglutinated by any of the seven immune sera. Of 73 strains examined, 10 were agglutinated by serum A, 13 by B, 25 by C, 42 by D, 11 by E, 25 by F, and 1 by G.

It would thus appear that from fermentation and serological tests it is impossible to regard *Proteus* as existing only in two types, *P. vulgaris* and *P. mirabilis.* As in the case of so many other bacteria, it is to be expected that a further examination of the group by more refined methods of analysis will reveal the fact that *Proteus* is composite, being made up of strains more or less biologically distinct. *Proteus zenkeri,* which in all probability is identical with *B. zopfii,* seems to be a microbe altogether different from *Proteus vulgaris.*

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W. B.

# ABSTRACTS

## NEUROLOGY

**Rose Bradford, J., Bashford, E. F., Wilson, J. A. Acute Infective Polyneuritis.** *Quart. J. Med.*, 1919, **12**, 45, 46, and 88.

The subject is treated under three heads: (1) the clinical phenomena of the disease, (2) the morbid anatomy of the disease in man and in the monkey, and the experimental production of the disease in the latter, (3) the isolation and culture of the virus of the disease.

Clinically, the disease differs from other forms of polyneuritis and is sufficiently characteristic to be regarded as a clinical entity.

A constitutional disturbance characterized by severe headache, pain in the back and vomiting, with fever, lasting for from two to four days and of moderate severity precedes by some four to six weeks the sudden onset of generalized paralysis. A latent period, therefore, separates the general symptoms from the paralytic phenomena, and during this the patient may feel well and carry out his ordinary duties.

The onset of paralysis is usually sudden. While on the march, numbness and tingling of the lower extremities and weakness of the legs come on rapidly. The legs are earliest involved, then the upper limbs and trunk muscles, and in about four days from the first onset bilateral facial weakness is established. The loss of power is general and does not pick out particular groups of muscles, though the proximal muscles are characteristically most profoundly affected. The involvement of the diaphragm and intercostals may be serious and is the common cause of death when this occurs. Very constant and characteristic is the facial weakness, and this may be associated with some labio-glosso-pharyngeal weakness, but not with the palatal or the ocular palsy seen in diphtheritic paralysis.

The paralysis is flaccid, and may have an ascending character. There are constantly both subjective and objective sensory disturbances, and these seem to have the character of those seen in other forms of polyneuritis.

The tendon-jerks are early abolished, and remain long absent. The plantars are also abolished early, as are the abdominal reflexes when the muscles subserving them are gravely paralysed.

There is no notable affection of the sphincters, nor any mental symptoms.

Tachycardia is common, as is albuminuria. The cerebro-spinal fluid is normal.

The mortality is high; eight deaths in 30 cases observed. Death usually occurs within the first week. In non-fatal cases progress is extremely slow, and is a matter of several months.

Microscopically, the peripheral nerves show the degenerative changes characteristic of polyneuritis, while the nerve-cells of the cord and brain-stem show chromatolytic changes. The brunt of the pathological process seems to fall upon the peripheral nerves of the lower limbs and upon the lower levels of the cord.

F. M. R. W.

**Leppmann, F.** (1) Polyneuritis nach (diphtheritischer?) Wundinfektion. [**Polyneuritis following wound infection (? diphtheritic).**] *Berl. klin. Wchnschr.*, 1919, **27**, 633.

**Leppmann, F.** (2) Polyneuritis nach Verletzungen. [**Polyneuritis following wounds.**] *Ztschr. f. d. ges. Neurol. u. Psychiat.* (Originalien), 1919, **49**, 198.

**Roper, E.** Schwere postdiphtheritische Lähmungen nach Wunddiphtherie. [**Severe postdiphtheritic paralysis following wound diphtheria.**] *Neurol. Centralbl.*, 1919, **14**, 450.

A series of cases following septic wounds is described. They are of interest if we regard their diphtheritic origin as proven, in the light they throw on the pathogenesis of diphtheritic paralysis, and the confirmation they afford of certain observations on this subject by F. M. R. Walshe in the *Lancet* of August 24, 1918.

In Leppmann's first paper two cases are recorded.

Case 1 was that of a soldier who in a mine explosion received among other wounds a large septic wound on the extensor aspect of the left upper arm. This was several weeks in healing, and slough formation upon its surface is recorded.

About six weeks from its occurrence, weakness of the left arm and paralysis of accommodation were observed. The latter cleared up in a week or two, but the weakness of the left arm increased and wasting appeared, and was followed about a month later by weakness of both legs, numbness of the feet, dragging gait, and disappearance of the knee- and ankle-jerks. A typical polyneuritis developed and ran its course over a period of four months, and was followed by complete recovery.

Case 2 was that of a woman who pricked the right middle finger with a needle. Pain and swelling of the hand, with enlargement of axillary glands followed. Cellulitis of the hand necessitated incisions.

The wound was healed within ten weeks. However, during the second month of the illness there had been, for a period of two weeks, paralysis of accommodation and defect of near vision, followed by pain and stiffness in neck and legs. When seen later the legs were weak, the gait stepping, knee- and ankle-jerks were absent, and there was unsteadiness of gait when the eyes where shut, and sensory loss over the limbs.

The polyneuritis recovered completely within six months.

Leppmann's second paper is an amplification of that reported above. In one case, regarded as postdiphtheritic, he comments upon the presence of a local paralysis related to the site of the infective focus as follows:—'Especially noteworthy is the fact that the local disturbance' (neuritis) 'in the wounded arm was the earliest, most intense and longest lasting. It was quite unassociated with any surgical finding in the wound, which was merely a local tissue necrosis readily healing.'

The paper also contains a comprehensive description of the characters of wounds infected by the diphtheria bacillus.

Röper records two cases, both unverified bacteriologically, but ascribed to diphtheria from the occurrence of paralysis of accommodation with the polyneuritis. In both instances the source was an infected gunshot wound, and in each the presence of a necrotic slough, such as is common in wound diphtheria, is recorded.

In one there was a penetrating wound of the thigh, and two months from its infliction, and while it was still unhealed, a peroneal nerve-palsy appeared. At about the same time the patient complained of visual disturbance, numbness of fingers and toes, weakness of the legs and ataxy. Examination revealed a polyneuritis, with paralysis of accommodation. There was no palatal paralysis. The local paralysis of the leg is ascribed to the wound and to scar formation in the thigh, though the delayed onset scarcely accords with this view.

In the second case there was a wound of the dorsum of the left hand, and in this also there appears to have been some local paralysis in addition to the accommodation affection and polyneuritis. There was no palatal paralysis.

In none of the cases recorded in these papers is there any bacteriological confirmation of their diphtheritic origin. Nevertheless, they accord so completely with the account of diphtheritic paralysis following wound and cutaneous infections given by Walshe; namely, a clinical picture including a local paralysis related to the infective focus, a paralysis of accommodation and polyneuritis, that there are good grounds for so regarding them. F. M. R. W.

**Wexberg, E.** Erkrankungen der peripheren Nerven im Kriege. [**Peripheral Nerve Diseases under War Conditions.**] *Ztschr. f. d. ges. Neurol. u. Psychiat.* (Originalien), 1919, **49**, 14.

A general account of the author's observations of peripheral neuritis from numerous causes. Of particular interest is a group of cases of polyneuritis classed as idiopathic, and of obscure origin. The author compares them to the 'acute febrile polyneuritis' of Gordon Holmes. They are characterized by acute onset, predominance of motor symptoms, minimal sensory changes and ataxic phenomena. The cranial nerves were usually unaffected. In several of these, cold and exposure seemed an important etiological factor.

Of post-infectious neuritides, diphtheria was the commonest cause of polyneuritis and typhoid of single nerve neuritis. In the latter the ulnar nerve was most frequently affected, then the peroneal. He regards them as 'toxico-traumatic', following Oppenheim's classification, and due to pressure acting on nerves rendered vulnerable by toxaemia.

Facial palsy, he ascribes mainly to cold. He concludes that alcohol has played a very minor part in the production of neuritis under war conditions.

Polyneuritis following dysentery, gonorrhoea, and pneumonia were of exceeding rarity. F. M. R. W.

**Oppenheim, H.** Beiträge zur Polyneuritis. [**On polyneuritis.**] *Deutsche Ztschr. f. Nervenh.*, 1918, **62**, 117.

A series of unusual and interesting cases of polyneuritis from various causes is described and discussed.

Case 1. **The clinical picture of postdiphtheritic paralysis following**

**faucial erysipelas.** The patient, a healthy man of 45, developed an acute febrile condition of the throat, diagnosed by Prof. Killian as 'Erysipelas pharyngis', which endured for eight days. Repeated examinations for the diphtheria bacillus were negative, though the organisms found are not recorded.

25 days after the onset, there appeared paralysis of soft palate and vocal cords lasting for some weeks, and two months from onset gradual weakness, numbness and ataxy of the legs developed, with abolition of the tendon jerks.

Examined by Oppenheim, who diagnosed degenerative polyneuritis ('névrotabès périphérique') following erysipelas faucium.

Complete recovery ensued after six months, the treatment being rest, strychnin injections, and diaphoresis.

Discussing this case, Oppenheim remarks on the extreme rarity of this clinical picture after a non-diphtheritic infection, though polyneuritis following erysipelas is known, and he concludes therefrom that this symptom complex cannot be accepted by itself as evidence of diphtheria.

The case also has an interest in relation to those of paralysis following wound diphtheria reported above, in which, following an extra-faucial diphtheria, the characteristic palatal symptoms do not occur, and tends to strengthen the view that these local phenomena are a manifestation of an ascending neural infection, and do not represent a specific action of the diphtheritic toxin upon selected parts of the nervous system.

Case 2. **Polyneuritis following mercurial treatment in a syphilitic.** The patient, a man of 39, complained of disturbances of vision, and examination revealed an early syphilitic choroiditis. A four weeks course of mercurial inunction was ordered, and was rapidly followed by a general feeling of malaise, by progressive weakness of the legs and arms, ataxy of both limbs, paraesthesiae of the extremities and gross defect of gait.

Examination revealed a marked hypotonus and ataxy of the limbs, with abolition of the tendon jerks, but little definite weakness or tenderness of muscles. There was no cutaneous sensory loss over the distal extremities, but marked position sense and vibratory sense loss in hands and feet.

The cranial nerves were normal throughout. There were no sphincter disturbances. Recovery occurred within four months.

Oppenheim regards the case as one of polyneuritis due to mercury. He compares it to Déjerine's 'névro-tabès périphérique' and considers the lesion in this case peripheral rather than spinal, though the acute ataxy may indicate an involvement of the posterior columns of the cord.

He discusses the question as to whether the polyneuritis is primarily syphilitic, or due to a provocative reaction of Herxheimer type brought about by the mercury, or whether mercury is the direct and sole cause, and concludes on the whole in favour of a mercurial origin. The reasons for regarding the condition as a sequela of mercurial treatment are discussed at length.

A case of polyneuritis following acute morphia poisoning is also described. The onset followed shortly after acute symptoms of poisoning in a patient who had developed a morphia habit during a course of treatment for a neurosis attended with insomnia.

Under the title 'mononeuritis migrans s. disseminata' or dissociated successive polyneuritis, Oppenheim describes two cases in which over a period of years, in patients otherwise healthy and with no abnormal antecedents, there occurred periodically a paralysis of a single cranial or spinal peripheral nerve lasting from two to three months.

The condition is regarded as idiopathic neuritis of unknown origin occurring in persons predisposed to affections of the nervous system. This leads Oppenheim to remark that of the series of 12 cases of neuritis recorded in the present paper, 9 showed a past or family neuropathic history, and he concludes that there are individuals who inherit a tendency to peripheral nerve disease, in whom from time there occur without appreciable cause attacks of neuritis. He is of opinion that the neuropathic diathesis favours the development of neuritis and polyneuritis. In such individuals any infection, toxaemia or other debilitating influence is apt to manifest itself in an affection of the peripheral nervous system. The small percentage of alcoholics and of cases of diphtheria who later develop polyneuritis is an indication of the probability that this view is correct.

F. M. R. W.

**Sicard, J. A., Roger, H., Vernet, A.** Les Zonas de la Face: zona du trijumeau et zona du nerf facial ou zona otitique. [**Herpes of the face.**] *Rev. Neurol.*, 1919, **1**, 15.

Apart from the recognized correspondence of a herpetic eruption with the distribution of the posterior roots in connexion with one or more posterior root ganglia, the authors draw attention to the frequent, but scarcely recognized, involvement of corresponding sympathetic ganglia and fibre systems.

Thus, in herpes of the lower two cervical and first dorsal posterior roots, the Claude Bernard-Horner syndrome is often seen (myosis, enophthalmos, narrowing of the palpebral fissure, &c.).

Further, the close resemblance between post herpetic neuralgia and causalgia, a known sympathetic reaction, the vasomotor disturbance preceding the eruption and the vesicles of the eruption itself all indicate involvement of the sympathetic system.

Within the territory of the cranial nerves, the close correspondence between the distribution of central nervous and sympathetic fibres found in the spinal segments has, from developmental causes, been lost. Hence spatially discreet motor, sensory, and autonomic manifestations may be seen in herpes in the distribution of these.

The anatomical arrangements in this respect of the trigeminal and facial nerves is discussed in detail, and underly the following classification of herpetic phenomena seen on the face.

**Trigeminal Zona.** (*a*) Total. Vesicles over the distribution of the three branches of the nerve, and, from involvement of sympathetic (cranial autonomic) ganglia on the trigeminal system, corneal, anaesthesia, myosis, enophthalmos and flattening of the cheek.

(*b*) Partial. Eruption limited to two neighbouring or to a single branch of the nerve.

(*c*) Associated; that is, with oculomotor or masticatory paralysis. This is from involvement of the third and motor fifth nerves as they lie near the Gasserian ganglion. It is usually transitory.

**Facial or Otitic Zona.** The lesion here is of the geniculate ganglion in its bony canal, and involves the adjacent facial, intermediate and eighth nerves.

(*a*) Total. Vesicles over the sensory distribution of the geniculate ganglion—over part of pinna and meatus. The chorda tympani and facial nerve are also implicated, as is the auditory with corresponding symptoms.

(*b*) Partial. The eruption of vesicles and slight auditory troubles are the only symptoms.

**Facio-Trigeminal Zona.** The lesion here is of both trigeminal and facial systems and includes the symptoms of both.

The diagnostic value of examination of the cerebrospinal fluid in zona is indicated, and it is stated that cases showing lymphocytosis are more prone to intractable neuralgic sequelae. F. M. R. W.

**Meige, H.** et **Béhague P.** Taches et placards vaso-moteurs du membre supérieur, à la suite d'une dénudation de l'artère humérale. [**Localised areas of vasomotor disturbance upon the arm following a denudation of the brachial artery.**] *Rev. Neurol.*, 1919, **3**, 219.

Following a wound of the right forearm, which entered upon the posterior surface and made its exit on the lateral aspect near the elbow, grazing the brachial artery in its course, the patient began to complain of violent 'pseudocausalgic pains' throughout the whole limb. Examination revealed no sign of nerve injury, there was some general weakness of the limb and movements were painful.

On the theory of a sympathetic involvement the brachial artery was stripped. Following this procedure there appeared over an area extending on the antero-internal aspect of the limb from the three inner digits to the axilla and on the chest in a zone from the axillary fold to the sternum, a series of small areas, sometimes discreet, sometimes confluent, of purple discoloration. These were not raised, were irregular in outline and recalled naevi in their colour.

They were considered to show neither a peripheral nor a root distribution, but to conform to the arterial distribution.

Also, on the limb it was noted that the pilomotor and sweating reactions were more facile than upon the opposite limb.

These phenomena were held to confirm the opinion that the underlying lesion was of the perivascular sympathetic network. F. M. R. W.

**Christian, H.** **The nervous symptoms of polycythaemia vera.** *Trans. Assoc. Amer. Physicians*, 1917, **32**, 558.

In this disease the characteristic reddish-cyanotic tinge of ears and mucosae may be lacking, and since subjective and even objective nervous phenomena are a striking feature of the disease, the diagnosis of cerebral disease may be made and the underlying condition missed.

In this communication 10 observed cases are reported. In 8 of these nervous symptoms were a marked feature. All the series occurred in patients in the sixth decade of life.

Headache, dizziness, transient amauroses and other visual disturbances were the commonest nervous symptoms. In others transitory diplopia, hemianopia, scotomata, and asthenopia were found.

Unilateral paraesthesiae, monoplegias and clonic movements resembling those found in the Jacksonian attacks of focal cerebral disease were recorded. Case IV of the series was indeed subjected to decompression on the diagnosis of cerebral tumour.

The patient was a man of 55, who for 20 years had suffered from recurring headaches, from fatigue of vision for 10 years. For 6 years there had been recurrent tingling of the left arm and hand. Six weeks before admission to hospital the left arm was definitely weak with wrist drop, while during two weeks preceding admission there had been intense headache, complete paralysis of the left upper limb with twitching movements, left-sided paraesthesiae, left facial palsy, weakness of the left leg and some difficulty in speech.

On examination, the typical cyanosis was present, there were 6,900,000 r. b. cs. and 180 per cent. Hb. In the nervous system there was oedema and hyperaemia of the discs, left hemiplegia with sensory loss and astereognosis of the left hand. The tendon jerks on this side were increased and a Babinski plantar response was obtained.

He died after a decompression operation.

*Post mortem* bilateral areas of cerebral thrombosis and of cortical degeneration, coronary thrombosis, mural aortic thrombosis, and splenomegaly were found.

In contrast to this, other cases merely showed the subjective symptoms mentioned at the head of the above list.

It seems probable that in the earlier stages the cerebral symptoms are due to circulatory disturbances, while the later more definite focal symptoms are the result of cerebral thrombosis, haemorrhages, and other changes of a permanent character. F. M. R. W.

**ROEMHELD, L.** Über ein eigentümliches Reflex-Phänomenon bei Urämie. [**A characteristic reflex phenomenon in uraemia.**] *Ztschr. f. d. ges. Neurol. u. Psychiat.* (Originalien), 1919, **50**, 284.

Numerous descriptions have been given of reflex changes in uraemia. Thus, increase of the tendon jerks, abolition of cutaneous reflexes and changes in pupillary reactions have been recorded by Fürstner (1898). Curschmann (1903) recorded the presence of the Babinski plantar response before the tendon jerk exaltation had developed. Fette (1910) expressed the view that this tendon reflex increase and extensor plantar response might be regarded as warning signals of the impending approach of uraemic convulsions.

The writer describes a case of uraemic coma in a woman in whom he found, besides general cutaneous hyperaesthesia and diminution of tendon jerks, that on eliciting a knee jerk there was a bilateral, predominantly contralateral plantarflexion of the four outer toes. There was no Babinski response.

Over what period of time this reflex was obtainable is not recorded, and whether this isolated observation justifies the manifest joy of its recorder in his priority must remain for future observation. F. M. R. W.

**SAMMIS, J. F. A case of scurvy with cerebral haemorrhage.** *Arch. of Ped.*, 1919, **36**, **5**, 274.

A year-old child of negro parentage was admitted to hospital acutely ill. Temperature was 104°, there was dyspnoea and evidence of severe pain in the limbs.

Examination revealed a child of but 11¼ lb. weight, with craniotabes and well-marked rickety bone changes. The gums were swollen and purplish in colour. The epiphyses were enlarged.

The illness was of a few days' duration, and it was stated that the child had been artificially fed with 'modified milk formulas' and had had the juice of half an orange 'since it was six months old'. Whether this was a daily or only the total allowance is not indicated.

Within a week of admission there was a generalized convulsion, loss of consciousness and rapid death.

Post-mortem revealed blood in both knee-joints, destruction of femoral and tibial epiphyses, subperiosteal haemorrhages, and blood in the medullary cavities of the bones. Spleen and kidneys showed haemorrhages. The liver was enlarged and fatty. The brain showed marked congestion of the cortical vessels, flattening of the convolutions, and a large clot lying over the right parietal lobe between dura and arachnoid.

F. M. R. W.

**Souques, A.** et **Lermoyez, J.** Goitre exophthalmique héréditaire et familial. [**Hereditary and familial Graves' disease.**] *Rev. Neurol.*, 1919, **1**, 20.

A record of seven cases among fifteen members of three generations of a family. Of these, four were actually observed. These were of the same generation, a brother and a sister, and two sisters their paternal cousins. Transmission was on the male side.

As cause, is suggested an hereditary fragility of the thyroid, rendering it peculiarly susceptible to disorder in the presence of infections or other debilitating conditions.

A bibliography is appended. F. M. R. W.

**Spiller, W. G. Congenital tumour of the brain (Telangiectasis) and associated cerebral movements.** *Arch. Neurol. and Psychiat.*, 1919, **2**, 1.

The patient, a boy of twelve years old and normally delivered, had been noticed to show weakness of the right limbs from earliest infancy. The first convulsion occurred just before admission to hospital and was followed by several others during the weeks immediately preceding his coming under observation. The fits were generalized and associated with loss of consciousness.

Mentally he was somewhat backward, and since birth had had telangiectases: three on the left side of the head and face and one on the back.

Examination revealed a slight right hemiparesis involving face and limbs. The right arm was maldeveloped. Accompanying voluntary movements of the right hand and foot were symmetrical associated movements of the corresponding extremities on the normal side.

The right hand showed loss of stereognosis. The tendon jerks on the right side were increased in facility, and there was a doubtful Babinski response from the right foot.

At operation the skull was trephined (osteoplastic flap) over the left Rolandic area. On reflecting the bone flap a dark bluish discolouration and bulging of the dura was seen. On incising this, a large venous space was opened and much haemorrhage occurred. The flap was therefore replaced and further exploration abandoned.

Some mental improvement is said to have resulted from this procedure. A review of recorded cases follows. The usual course of such tumours clinically appears to show a history of defect symptoms varying according to the site of the growth, with an onset of irritative symptoms in later childhood or early adult life. In many cases telangiectases of the face and head are found and are of diagnostic value.

There is a brief discussion on the genesis of associated movements resulting from cortical defects. F. M. R. W.

**Imamura, S.** et **Ichikawa, K.** Atrophie optique familiale avec tremblement et décheance intellectuelle. [**Familial optic atrophy with tremor and mental changes.**] *Rev. Neurol.*, 1919, **4**. 277.

Report of a brother and sister of normal personal and family antecedents, who at the ages of 18 and 24 respectively, rapidly developed visual defect which progressed within a few months to a permanent and gross impairment of visual acuity.

The brother (the elder) on examination showed a central scotoma to white and colours of from 30° to 40°. There was no peripheral limitation of vision. Acuity was reduced to finger counting. The fundus showed on each side the signs of post-papillitic atrophy.

The sister also showed a central scotoma of from 10° to 15° in all meridians. Acuity was reduced to finger counting. The discs showed some blurring of the edges and hyperaemia, but no swelling. Ultimately this subsided to secondary atrophy, and some peripheral limitation of vision developed.

To these phenomena which correspond to those of Leber's atrophy were superadded other nervous and mental symptoms.

In the brother these consisted in irregularities of ocular movement; nystagmus, want of parallelism in movement, with outward and upward deviation of the right eye in the median position. There were no mental changes.

The sister showed marked fatuity, slowness of cerebration, poorness of memory. There was some apparent weakness of the right face, fibrillary twitching of the facial muscles during movement. The eye movements showed defects similar to those described in the brother. There was tremor of the tongue and limbs, and rigidity and clumsiness in all movements.

The reflexes and sensation were normal.

In neither case was there any evidence of syphilis.

These cases are contrasted with a series described by Behr, in which six mentally defective boys with Leber's atrophy showed signs of pyramidal and cerebellar defect. F. M. R. W.

**Siemerling, E.** Über eine Enzephalitisepidemie. [**An epidemic of Encephalitis.**] *Berl. klin. Wchnschr.*, 1919, **22**, 505.

The writer describes a series of cases of encephalitis lethargica occurring at Kiel in the winter and spring of 1918–19, which were characterized by the prominence of mental disturbances. These rendered early diagnosis difficult, and suggested simple acute pyschoses. Observation, however, revealed that the psychical disturbances overlay signs of gross brain disease. The mental symptomatology varied widely in the different cases, from emotional disturbances such as irritability and attacks of weeping, forgetfulness, and apathy, to delirium, extreme restlessness, and well-formed delusions.

In a girl, trismus so persistent and intense as to render nutrition almost impossible was associated with marked irritability, attacks of weeping, and spasms of the back and neck muscles producing opisthotonus, suggesting in the early stages a hysterical condition. Death occurred on the twelfth day.

Throughout the series ocular palsies were the most constant feature. Common, also, were nystagmus, sluggish reaction of pupils, signs suggesting a meningitis such as stiffness of the neck muscles, epileptiform attacks, pain in head and neck, and fever, tremor, and ataxy.

The lethargy was very characteristic, and differed from the drowsiness of cerebral compression in showing a greater resemblance to natural sleepiness. Unsteadiness of gait was very marked in more drowsy cases.

Although these cases occurred at a time when the influenza epidemic was at its height, and five of them gave a very recent history of this disease, Siemerling regards them as belonging to the group of cases described as lethargic encephalitis, and as differing from the cases showing cerebral and mental symptoms after influenza. F. M. R. W.

**Bassoe, P.,** and **Hassin, G. B.** **A contribution to the histopathology of epidemic ('lethargic') encephalitis.** *Arch. Neurol. & Psychiat.*, 1919, **2**, 24.

The report is based upon the examination of three cases. The histological findings are summarized as follows. There was a mild leptomeningitis; the vessels of the pia being congested, with marked perivascular infiltration with plasma cells and lymphocytes.

In the cerebral cortex parenchymatous changes predominated; chromatolysis, neuronophagia, and glia cell proliferation. Vascular changes were minimal. In the basal ganglia, substantia nigra, and tegmentum, in addition to the parenchymatous changes detailed above, there were marked interstitial changes; plasma cell and lymphocyte infiltration round the vessels so as to occlude these.

The internal capsule, pons, and cord showed mainly these interstitial changes. The fibres of the hemispheres showed no myelin degeneration.

They conclude that both parenchymatous and interstitial changes exist independently. The findings are characteristic of an encephalitis and differ from those found in Wernicke's polioencephalitis superior and in influenzal encephalitis in the absence of foci of softening, of large haemorrhages, and in the absence of polymorphonuclear leucocytes and gitter cells.

They consider that epidemic encephalitis is a disease *sui generis*, but that the histological picture is indistinguishable from that found in African sleeping sickness due to tripanosome infection. F. M. R. W.

## BACTERIOLOGY

**von Gutfeld, F.** Die Serologie des Fleckfiebers (Sammelreferat). [**The serology of Typhus (General Review).**] *Med. Klin.*, 1919, **15**, 691..

In the beginning of 1916 Weil and Felix announced that they had isolated a proteus bacillus from the urine of a typhus patient, which was agglutinated by the serum of a typhus patient. This organism was referred to as strain X 2, but later, Felix obtained another culture, X 19, which was agglutinable to a much higher titre. With this latter strain all subsequent work has been carried out. The authors did not claim that the X bacillus was the cause of typhus, but that the reaction between it and the serum of patients was of value in the diagnosis of typhus.

All authors are now agreed that the reaction is diagnostic of typhus in a dilution of serum 1 in 50 or higher. In about 10 per cent of non-typhus cases an agglutination may be observed with 1 in 25 serum. The cultures should be three days old, i.e. they should be incubated for 24 hours and then left for two days in the ice chest. The test should be carried out at 37° C., the tubes being read after two hours, and again after six to eight at room temperature. In the stronger concentrations of serum the agglutination sometimes fails, but this difficulty may be overcome by heating the serum for 30 minutes at 56° C. before use. A positive agglutination with 1 in 50 serum is diagnostic. In typhus cases the reaction may be positive on the fourth day of the disease, and if it is repeated the result may be obtained in a higher dilution.

X bacilli have been isolated from the blood, faeces, and urine of typhus patients and also at the autopsy, but success is only obtained in a small number of cases. They may also be obtained from the faeces of non-typhus cases.

Ordinary (*vulgaris*) proteus strains, X 2 and X 19 strains, are apparently only distinguishable by the greater agglutinability of the latter.

Complement fixing substances may constantly be detected in the blood of typhus patients using bacillus X 19 as an antigen. P. F.

**Fletcher, W.** and **Mackinnon, D. L. A contribution to the study of chronicity in dysentery carriers.** *Med. Research Committee, Spec. Rep. Series*, No. 29, 1919.

The authors examined in all 935 men convalescent from dysentery and 847 men with other diseases, but chief emphasis is laid on 229 dysentery convalescents, whose histories were thoroughly enquired into. About half of these were recovering from their first attack; the others had had more than one attack.

Sixty-one were found to be carriers of Flexner bacilli; 13 were Shiga carriers; 122 had *Ent. histolytica* (of these nine had bacilli also); 42 were negative.

In the whole series of 935 men, 5·5 per cent. were Flexner carriers and 1·3 per cent. Shiga carriers, while among the 847 non-dysentery cases there were 1·0 per cent. of Flexner carriers, but no Shiga carriers.

All men infected with Shiga were persistent carriers, and were permanently unfit for work in the Army, but only one-fifth of the Flexner carriers were persistent. In these the carrier condition is very intermittent; bacilli may be absent from the stools for four or five weeks and then reappear. Nearly all Flexner carriers were fit for work under favourable conditions, but the authors protest against such cases being sent on active service, since they nearly always relapse. P. F.

**Gettings, H. S. An investigation of the Flexner-Y group of dysentery bacilli.** *Med. Research Committee, Spec. Rep. Series*, No. 30, 1919. [This paper was compiled for the press from the author's notes after his decease by **S. R. Douglas.**]

The object of this work was to find to what extent bacilli of the

Flexner-Y group could be subdivided into sub-groups by means of fermentation, agglutination, or absorption of agglutination. The conclusions are based upon the examination of 285 strains isolated from cases of asylum dysentery.

It was found that no subdivision was possible upon a basis of fermentation even when a large-series of sugars was used.

Agglutination was carried out with two monovalent sera prepared from the author's strains. It was clear from these results that serological subgroups did exist, but the reactions were too variable accurately to define the limits of these.

The absorption of agglutinin tests were made with 95 different strains. By means of four monovalent sera selected from the series it was found possible to sub-divide 92 of these strains into four sharply defined subgroups. Sub-group I contained 40 members, II 30 members, and III and IV 11 members each. The three strains remaining over could not be identified as falling into any of these sub-groups. Sub-group III probably corresponds to the 'Y' sub-variety of the Flexner group. P. F.

**MacAdam, W. An account of an infection in Mesopotamia due to a bacillus of the Gaertner-Paratyphoid group.** *Lancet*, 1919, ii, 189.

From a series of patients in Bagdad the author isolated by blood culture nine strains of a paratyphoid organism, which was abnormal in its serological reactions. The cultural tests were identical to those given by *B. paratyphoid B*, but specific 'B' serum did not agglutinate it at first, although after numerous sub-cultures a slight agglutination was obtained. A serum prepared from this bacillus had a specific action upon all strains, but only a slight effect upon Paratyphoid B strains. The author was unable to compare his bacillus with an undoubted example of *B. aertrycke*, but it differed from an alleged *B. aertrycke* strain with which he was supplied.

Clinically the cases did not suggest enteric infections; pulmonary symptoms were usually most in evidence. P. F.

**Perry, H. M.** and **Tidy, H. L. A report on the investigation of an epidemic caused by bacillus aertrycke.** *Med. Research Committee, Spec. Res. Series*, No. 24, 1919.

An investigation into the nature of an epidemic of diarrhoea with 4 deaths which occurred among troops in a camp. The disease was characterized by diarrhoea of varying degrees of acuteness, with vomiting in the severer cases. The onset was sudden, pyrexia was the exception. A bacillus identical with *B. paratyphosus B* was isolated from the stools of the cases, but upon closer investigation by means of agglutinin absorption tests it was found to differ from Paratyphoid B and to correspond to *B. aertrycke.*

The authors formed the conclusion that the outbreak was due to a human carrier on the grounds that one of the cook-house staff had *B. aertrycke* in his stools, and had suffered from recurrent diarrhoea for some time previously. P. F.

**Dudley, S. F. A note on B. influenzae.** *Lancet*, 1919, ii, 476.

The author is satisfied that success in the isolation of *B. influenzae* depends entirely upon the use of a proper medium. Ordinary blood agar is useless. Matthews' medium was the best in his hands.

Microscopical examination of sputum gives very little indication of the probability of finding *B. influenzae* profusely in culture.

The author, working in a hospital ship, made a study of the presence of *B. influenzae* in the throats of healthy persons. During the epidemic period 90 per cent. of the nursing staff were carriers, but from the middle of March, when the number of admissions declined, the number of carriers also declined. Small samples taken from other ships indicated that a large number of the healthy men were carriers. P. F.

**Muir, R.** and **Wilson, G. H. Influenza and its complications.** *Brit. M. J.*, 1919, i, 3.

Using a human blood agar, the authors had little difficulty in isolating *B. influenzae* as minute pin-point colonies from the sputum of cases or from the bronchial mucosa, lungs, &c. at autopsies. Blood cultures were negative as regards this organism. Out of 30 fatal cases in only 4 could death be ascribed to the intensity of the influenzae infection, the cause of death in the others being pneumococci, streptococci, staphylococci, and in one case meningococci. Influenza bacilli were associated with the fatal cases almost invariably, they were specially related to the broncho-pneumonia. They were often the predominating organism, and abounded not only in the bronchioles, but also in the air vesicles. This alveolar lesion was the furthest extension downwards of the bacterial infection, thus *B. influenzae* may be the real cause of the disease, lowering the tissue resistance and paving the way for the attacks of secondary organisms. There is a possibility that an ultra-microscopic organism underlies all the phenomena, but it appears that *B. influenzae* at least plays a very important part in the production of the lesions. P. F.

**Wilson, W. J.** and **Steer, P. Bacteriological and pathological observations on influenza as seen in France during 1918.** *Brit. M. J.*, 1919, i, 635.

The authors examined 72 fatal cases of influenza *post mortem*. They isolated *B. influenzae* 57 times from the bronchi, 12 times from the heart blood, 3 times from 8 pleural fluids, and 'once from 7 pieces of lung substance'. Pneumococci, staphylococci, and streptococci were very frequent in the bronchi and heart blood. Meningococci were met with twice in each situation. They look upon *B. influenzae* as an essential factor in influenza paving the way for secondarily infecting bacteria. They compare its action with that of mustard gas in its relation to infection of the lungs. P. F.

**Gibson, H. G., Bowman, F. B.** and **Connor, J. I. The etiology of influenza.** *Brit. M. J.*, 1919, i, 331.

In this paper the authors continue publication of the grounds upon which they claim to have discovered the cause of influenza to be a filter-passing virus. 'The present report is merely a summary of the work done to date, and is framed in as concentrated a form as possible.' It is intended to publish details of the work later.[1]

They record 80 per cent. of 'positive results' as the result of inoculating monkeys with sputum, filtered and unfiltered, according to the method of

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[1] More detailed results of this work have just been published by the Medical Research Committee in No. 36 of their Special Report Series (London: H.M. Stationery Office).

Nicolle and Lebailly (*vide* this Journal, 1919, **1**, 106). They also obtained 'positive results' in rabbits, guinea-pigs, and mice.

Experiments are then mentioned in which filtered blood from influenza patients was inoculated into monkeys and mice. These animals were found to develop lesions of the lungs associated with congestion or 'inflammatory reaction'.

A passage experiment was made with filtered influenza sputum. Having infected a rabbit with this, the virus was transmitted in series through two other rabbits, using the filtered lung juice as the inoculum. The last rabbit died one hour after the inoculation, thus showing an increased virulence of the virus. The lesions produced in these animals are described shortly: thus, congestion of the trachea, pleura normal, thymus engorged and haemorrhagic. kidneys and liver deep red. The findings in the case of the lungs of the last rabbit may be quoted. 'Both lungs appear much the same. Generally they are pink, with an overlying crimson and deep red coloration which looks haemorrhagic. It seems, in the gross, to be an extreme grade of what has previously been seen in infected rabbits' lungs. On section, the surface drips bloody fluid, and shows numerous deep red small haemorrhagic areas on the cut surface.' Cultivations of the virus were made in undiluted ascitic fluid containing kidney in the manner of Noguchi. The ascitic fluid used 'proved to be sterile' on collection, and was not subjected to any sterilization. The first culture was obtained by using the kidney of one of their 'positive' experimental rabbits. They describe the formation of a clear pale-red zone above the kidney and a cloudiness of increasing opacity. Subcultures were made for 'non-filtrable contamination, and this was found to be absent'. Smears were stained by Giemsa for 24 hours and numerous 'small coccoid bodies' were found. The cloudy material transferred to another Noguchi tube grew in the same way.

Animals were infected with these cultures, and the coccoid bodies were cultivated from their organs. For instance, a rabbit was inoculated and killed after a week, and 'although the lungs of the animal did not show any typical signs of a marked infection, a culture was obtained from the rabbit's kidney'.

The authors claim (in some places with a slight degree of qualification) that these 'coccoid bodies' are the cause of influenza, and state that after an exchange of material with Wilson (*vide* this Journal, 1919, **1**, 40) they are mutually satisfied that their organisms are the same.

In view of the wide scope of this work it is essential to point out that 'these experiments were brought to an end by the cessation of the epidemic and the loss of laboratory attendants consequent on demobilization'. Further, owing to his regrettable death on active service, 'Major Gibson had no opportunity of revising or even finishing the summary, which has had to be completed from his notes and records'. Thus, and in view of the lack of information upon certain technical details, the more extended publication promised by the authors will be awaited with interest. P. F.

**Arkwright, J. A. A criticism of certain recent claims to have discovered and cultivated the filter-passing virus of trench fever and of influenza.** *Brit. M. J.*, 1919, ii, 233.

In a number of papers recently published (cf. *Quart. J. Med.*, 1918–19, **22**, 88) Bradford, Bashford, and Wilson claimed to have discovered the cause of influenza, trench fever, and a number of other diseases in a 'filter-passing virus' which was cultivated by 'Noguchi's method'. The present author undertook the task of repeating their work, and, after examining material supplied by Wilson, comes to the conclusion that Bradford, Bashford, and Wilson were misled in the observations upon which they made their claims.

In a note attached to the paper Wilson admits the force of Arkwright's criticisms, but appears still to be prepared to attach aetiological importance to certain bodies in his cultures which Arkwright describes as deposits of protein. He concludes 'that it has not been proved (by his work) that a filter-passing organism has been grown in *pure* (italics of reviewer) culture in any of the diseases for which the claim was made' and the impression is left that he still envisages the possibility that the influenza (&c.) virus may be present in his cultures as a filter-passer, but in an impure state. P. F.

**Browning, C. H.** and **Gulbransen, R. Observations on the chemo-therapy of bacterial infections, with special reference to experimental pneumococcus infection.** *J. Path. & Bacteriol.*, 1919, **22**, 265.

In connexion with the recent polemic relating to the treatment of war wounds, the authors have conducted experiments to show that antiseptics *can*, under certain circumstances, modify *in vivo* an infection which would otherwise be fatal. They do not, however, claim that the conditions they have set up are comparable with the conditions in a war wound.

Mice were inoculated intraperitoneally with a fatal dose of pneumococci and 10 to 15 minutes later a dilution of proflavin was also introduced. Some survived and others died. If the proflavin was given after 30 minutes all animals died. Every series of experiments was not successful in showing this effect of proflavin.

It was found that if too much antiseptic was given the animals might die, while a smaller dose might save them. Further, if the pneumococci were added to the proflavin immediately before inoculation a mild peritonitis, without death, might result.

From these latter observations the authors conclude that the protective action is not due to the antiseptic alone, but to a 'co-operation' between the antiseptic and the tissues.

They remark that they have obtained similar results with carbolic and corrosive sublimate. P. F.

**Wang, C. Y. Detection of diphtheria bacilli in swabs by means of fluid serum.** *J. Path. & Bacteriol.*, 1919, **22**, 229.

A method for improving the results of the routine examination of diphtheria swabs.

Place undiluted ox serum (no other) into test tubes, 2·5 c.c. in each. Sterilize at 56° C. in water for three hours on three consecutive days. Test for sterility. The infected swab is placed in this medium and incubated in a horizontal position. Make films from the swab and stain.

The author examined 250 swabs and found *B. diphtheriae* in 68 specimens by his method, while Loeffler's medium only revealed them in 52. The fluid medium was always positive when Loeffler was, and the bacteria were often more abundant.

When *B. diphtheriae* was present the author's medium nearly always became acid; it never became alkaline to litmus. P. F.

**Short, J. T. The incidence of meningococcus carriers in a naval training station during 1918.** *J. Infect. Dis.*, 1919, **25**, 163.

In a naval training establishment all incoming and outgoing drafts and contacts of cases were examined as carriers of meningococci, and the results are charted to show the weekly incidence of carriers detected over a period of twelve months. A curve showing the incidence of cases of cerebro-spinal fever is superimposed.

Sporadic cases of fever occurred during the whole year, but a sharp outbreak was observed during January. At the beginning of this outbreak the carrier rate was low, but it rose a fortnight later; thus 'it is difficult to account for the new cases on a basis of an increase in carriers'. This view is supported by the fact that although at first carriers were isolated, the epidemic nevertheless occurred: while it rapidly declined in spite of the liberation of carriers.

Meteorological records show that the outbreak coincided with the period of coldest weather.

The author considers that the number of carriers is not the most important factor in causing cerebro-spinal fever, but overcrowding, over-training, immaturity, fatigue, and exposure. P. F.

**Wang, C. Y.** and **Crocket, J. Diagnosis of tuberculosis by the complement deviation method.** *Brit. M. J.*, 1919, ii, 7.

The essential feature of the authors' method is the use of a lipoid-free antigen, prepared as follows:

The surface growth upon flasks of glycerine veal broth is transferred to a bottle and dehydrated with repeated changes of absolute alcohol. After removing the alcohol, 100 c.c. of ether are added for every 10 gm. of moist bacilli. Shake for 2 hours, centrifuge and remove the ether. The same amount of chloroform is now added and shaken as before. Without removing the chloroform, add 3 times as much ether and shake again for 2 hours. Centrifuge and repeat the extractions with ether and ether-chloroform 5 times. Dry the residue and store in the dark. For use grind 100 mgm. of residue with 3 c.c. of saline in a mechanical mill overnight. Make up to 100 c.c. and add 0·5 per cent. of carbolic acid.

The technique of the test follows the usual lines adopted for complement fixation work, but no control appears to be included of the effect of the antigen alone upon complement, nor is there any statement relating to any anti-complementary action of the antigen.

The sera are tested simultaneously with a Wassermann antigen.

According to the authors it is known that a tuberculous serum may rarely give a positive reaction with a Wassermann antigen, and, conversely, a syphilitic serum a positive with a tuberculous antigen. In these cases, they mix the serum with an equal part of saline, and for each c.c. of the mixture add 2 or 3 drops of chloroform. Shake for 10 to 15 minutes, heat to 55° for 15 minutes, and repeat the test with the supernatant fluid. If the inhibition is now stronger with the tubercle than with the syphilitic antigen, the case is both tuberculous and syphilitic. If the reverse is the case, the serum is probably syphilitic and not tuberculous. The *rationale* of this differentiation is not stated.

The results are on the whole similar to those obtained by previous workers. For example, 57 cases of phthisis with T. B. in the sputum gave 32 strong positive reactions, 17 partial reactions, and 8 negative. 120 normal sera were negative.

On the other hand, 100 syphilitic sera gave 7 positive, 34 partially positive, and 59 negative. The positive syphilitic sera were then tested by the chloroform method and became negative to the tubercle antigen, although 30 further cases of mixed syphilis and tubercle remained positive to tubercle even after the chloroform test. P. F.

**WATANABE, S. A comparative study of haemolytic complement and antibodies in oxalated plasma and serum.** *J. Immunol.*, 1919, **4**, 77.

The author has added a contribution to the much discussed question whether or not complement exists in the circulating blood, or whether it develops only after the coagulation of the blood, and as a result of injuries to the leucocytes. The method adopted by Watanabe was based on that of Meeker, and combined the use of sodium oxalate and paraffin. A centrifuge tube was marked to indicate a volume of 20 c.c., and 1·0 c.c. of a 2 per cent. solution of sodium oxalate was added. This solution was then dried in the tube over a flame up to, and a little beyond, the 20 c.c. mark, the remaining part of the tube being coated with a thin layer of paraffin. Blood was now run into the tube. which was immediately centrifuged at a high speed, the resulting plasma being transferred to a second similarly coated tube, and centrifuged again. In all cases the oxalate plasma was compared with serum from the same blood.

A long series of experiments are detailed, in which it is shown that the oxalated plasma exerts no deleterious influence on haemolytic complement or antibodies when the quantity of oxalate is 0·001 grm. per c.c. Oxalated plasma of normal or syphilitic persons and normal and immunized rabbits, contains haemolytic complement in the same or somewhat greater amounts than the corresponding sera. Oxalated plasma of syphilitic persons contains the same amount of Wassermann reacting substance as sera. The same is true of haemolysins, agglutinins, &c., whether from naturally immune or artificially immunized animals, the conclusion being that complement and antibodies of different kinds exist free and preformed in the circulating plasma of the blood. The research was carried out under Kolmer's direction in the laboratory of experimental pathology of the University of Pennsylvania, W. B.

**SCHMIDT, C. L. A., and BENNETT, C. B. Is Haemoglobin antigenic?** *J. Infect. Dis.*, 1919, **25**, 207.

The diverse statements in the literature as to the antigenic action of haemoglobin are due to the use of slightly impure haemoglobin. During crystallization a small fraction of impurities is very apt to be carried down. The authors used three different preparations of dog's haemoglobin, repeatedly crystallized, and immunized rabbits with these. No haemolysins or agglutinins were formed. Guinea-pigs could not be sensitized. Haemoglobin in large doses was quite non-toxic to guinea-pigs, although a much smaller proportionate dose of globin was toxic. P. F.

**Vedder, E. B. The production of anti-human haemolysin.** *J. Immunol.*, 1919, **4**, 141.

The difficulty in producing high titre haemolytic serum against human corpuscles is due to an agglutination *in vivo* of the inoculated cells causing death of the rabbit before a high haemolytic titre has been reached.

It is better to immunize the animal intensely at first, namely, 4 c.c. of deposited washed cells on each of three successive days, and then after two to three weeks to continue with very small doses: five to six daily doses of 0·5 c.c. of cells.

Experiments were made to determine which fraction of the red cell was the antigen for haemolysin. Difficulties were encountered in making stroma. the following method was therefore evolved:

Washed red cells were deposited in the centrifuge and measured. Add an equal part of saline, and bubble through coal gas for 20 minutes. Centrifuge and remove the saline. Add 'sufficient' distilled water to haemolyse and leave 'for an hour or so'. Centrifuge at high speed to separate the stroma. About one-third of the original volume of corpuscles should be obtained as stroma, and it is then made up with saline to the original bulk of corpuscles.

This stroma is capable of fixing haemolysin *in vitro* and becoming dissolved on the addition of complement.

Rabbits will furnish a good haemolytic titre if injected with 1 c.c. of stroma followed by three doses of 2 c.c. at five-day intervals. Numerous attempts were made without success to produce haemolysin with the extracted lipoids of red blood cells. If stroma is dissolved with dilute NaOH and then neutralized with acetic acid a globulin precipitate may be removed and washed with distilled water. An NaOH solution of this globulin produced no haemolysin, but the remaining solution of globulin-free albumens produced a good haemolytic serum in rabbits. It would, therefore, appear that the haemolytic antigen is a specific albumen.

P. F.

**Fildes, P., and Parnell, R. J. G. An analysis of the results of Wassermann reactions in 1,435 cases of syphilis or suspected syphilis.** *Med. Research Committee, Spec. Rep. Series*, No. 23, 1919.

The object of this work was to show how the results of the Wassermann reaction compare in routine practice with the clinical findings. For this purpose the cases of 1,435 consecutive admissions to hospital were reviewed, the admissions being for syphilis or suspected syphilis. The tests were carried out by the technique of Fildes and McIntosh without knowledge of the clinical condition or history.

1,177 men gave positive Wassermann reactions, and of these 1,112 showed more or less conclusive evidence of syphilis. With regard to the 65 men with positive reactions who did not show conclusive evidence of syphilis, the great majority had gonorrhoea or sores upon the penis in which spironemes could not be found owing to previous local or general treatment. The authors state: 'Although we are unable to *prove* that every case in the series which gave a positive Wassermann reaction was syphilitic, nevertheless we are of opinion that a reasonable critic can hardly dispute the overwhelming importance of this result in diagnosis'.

258 men gave negative reactions, and 171 gave conclusive evidence of being syphilitic (spironemes in chancres, &c.). Eleven had no active lesions,

but histories of syphilis. The remainder were in all probability non-syphilitic.

Taking the material from a different point of view:

There were 1,359 cases of syphilis, of these:

1,177 gave positive reactions.
161 gave negative reactions, but had spironemes in sores.
5 gave negative reactions, with sores without spironemes, but subsequently developed syphilis.
1 gave a negative reaction with manifest secondary syphilis.
2 gave negative reactions with manifest tertiary syphilis.
2 gave negative reactions in the serum with cerebrospinal syphilis.
11 gave negative reactions with no lesions but histories of syphilis.

Therefore 'it may be said that negative reactions in cases of syphilis which exhibit manifest signs (excluding early primary cases: Reviewer) are very rare whether they have been treated or not, and thus the negative test is of very great significance in the exclusion of a diagnosis of syphilis'.

Clinical and pathological details of the whole series of cases are appended. P. F.

**Obata, I. On the nature of eclampsia.** *J. Immunol.*, 1919, **4**, 111.

Although a vast amount of attention has been directed to the question of the pathology of puerperal eclampsia the problem cannot be regarded as solved. Following the work of Dold (published in Japanese only) that extracts of normal viscera in saline solution possess toxic properties which can be neutralized by normal serum, Obata has now studied the symptoms and lesions in mice, following the intravenous inoculation of extracts of normal and eclamptic placentae and the capacity of normal or eclamptic serum to neutralize the same. After an interval of 10 to 30 seconds, mice, injected with saline extracts of normal human placentae, become excited and suffer clonic and tonic convulsions succeeded by violent dyspnoea, coma, and death within three minutes. Extracts of eclamptic placentae produce similar symptoms but in somewhat smaller doses. Sera of normal and eclamptic persons do not differ materially in their toxic effects, and the poisonous properties of eclamptic serum during the seizure are not in excess of those in the intervals between the fits. The capacity of normal serum, whether from males or from females, pregnant or otherwise, is almost uniform, and is such that 0·2 to 0·3 c.c. will inhibit the action of 1·0 c.c. of placental extract. On the other hand, this neutralizing power is considerably less in the serum of eclamptic women during the attack. By the fourth or fifth day of the puerperium in eclamptic women the normal titre of the serum is restored. The author therefore concludes that puerperal eclampsia is an intoxication, by placental poison, which is made possible by a weakening in its normal capacity of neutralization on the part of the maternal blood. The nature of this process of weakening is being investigated further. The pathological changes induced by the injection of normal placental or eclamptic extracts are essentially the same but differ in degree, and consist of haemorrhages, fatty degeneration of the liver, and cloudy swelling of the kidney. To the paper is appended a succinct account of the various theories of eclampsia. W. B.

**Jones, H. M. A rapid hydrogen electrode method for determination of hydrogen ion concentrations in bacterial cultures or in other turbid or coloured solutions.** *J. Infect. Dis.*, 1919, **25**, 262.

In this paper the author gives:

1. Details of a simplified apparatus for the determination of hydrogen-ion concentrations.
2. The meaning of $P_H$.
3. A short account of the method of measuring the $P_H$ value of a solution.

With a normal calomel electrode of 280 millivolts, and taking an increase of unity in $P_H$ as equivalent to an increase in E.M.F. of 58 millivolts, he adopts the equation $P_H = \frac{\text{E.M.F.} - 280}{58}$ for the conversion of measurements of E.M.F. into $P_H$. A careful account is given of the method of construction of a hydrogen electrode vessel from quite simple apparatus. The author uses 3N. KCl as the connecting solution. The apparatus consists of: a Wheatstone Bridge, galvanometer, Weston standard cell, accumulator, calomel electrode, hydrogen electrode, and some switches. It is stated to be accurate to 0·5 millivolt or 0·01 $P_H$. As compared with the colorimetric method, he says it has wider application, is more accurate, less cumbersome, and only slightly less rapid. W. A. M. S.

## RADIOGRAPHY

**Dimier** et **Bergonié**. Recherche du filaire de Médine par la radiographie. [**Guinea-worm revealed by X-rays.**] *Archiv. d'électr. méd.*, 1918, **26**, 337.

Usually animal parasites are so transparent to X-rays that their existence in the body is not revealed by these means: when calcified, however, they may be recognized. The authors found evidences of Guinea-worms in several wounded soldiers from Guinea and Senegal, in whom the existence of an abscess called for treatment. Apart from radiological examination the abscess might have been suspected to depend upon some military injury. The entozoa were always found in the usual situation, viz. leg or lower part of thigh, and the X-ray examination showed a tortuous coiled arrangement of the worm. W. S. L.-B.

**Key** und **Åkerlund**. Fall von verkalktem Aneurysma in der Arteria renalis. [**Calcified aneurysm of the renal artery.**] *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1918, **25**, 551.

A somewhat laborious description of what appears to be a condition hitherto undescribed in radiological literature. The aneurysm was about the size of a hazel nut, its existence at the hilus of the kidney was recognized under the X-rays, an operation was done on the supposition that the case was one of renal stone, and the gush of arterial blood which took place and necessitated ligature of the artery and extirpation of the kidney afforded the first indication of the nature of the mass. Recognition of the condition as a source of possible error in diagnosis is desirable, but reduction of the paper to a quarter of its length would have been advantageous.

W. S. L.-B.

**Edling.** Ein sehr seltener Fall gutartigen Lungentumors. [**A case of non-malignant tumour of the lungs.**] *Fortschr. a. d. Geb. d. Röntgenstrahlen,* 1917–18, **25**, 25.

In the left lung of a woman, who presented no pulmonary but merely nervous symptoms, an oval shadow was found accidentally under the X-rays which was thought to be either a hydatid cyst or a non-malignant growth, from the sharp outline and its being surrounded by normal lung tissue. The mass was the size of a tangerine orange, and grew somewhat between the first and second X-ray examination. After much consideration the patient was subjected to operation, and the mass was removed successfully. Recovery was uneventful. It proved to be a non-malignant tumour largely composed of cartilage, but also containing fatty tissue, connective tissue, unstriped muscle fibres, and collections of lymphocytes. The whole tumour was covered with a simple epithelial layer of non-ciliated cubicocylindrical cells. The shape and sharp limitation of the shadow (along with the absence of change in the surrounding lung tissue) argued against an infective process such as gumma. Nor was there reason to suspect a secondary malignant mass, while the same characters of the shadow eliminated mediastinal growth or enlarged tuberculous glands.

W. S. L.-B.

**Japiot.** Fracture du scaphoïde sans déplacement décelée par la radiographie. [**Fracture of scaphoid without displacement, shown radiographically.**] *Progrès méd.*, 1919, 378. [Abstracted from *Archiv. d'électr. méd.*, 1919, **27**, 54.]

On a wounded man presenting simply the clinical signs of a fracture of the styloid process of the radius (following on a fall on to the hand) radiography revealed, besides the foreseen lesion, a fracture of the scaphoid, Y-shaped and without displacement. A frontal radiograph alone was not sufficient for this diagnosis; proof by a side-view was necessary. With the wrist lying with the radial side downwards on the plate, the shadow of the scaphoid was thrown by turning the back of the wrist toward the plate. The author insists on the rarity of the combination, viz. fracture of the scaphoid and of the styloid process of the radius. He mentions besides, the necessity for methodical examinations, the utility of comparative radiographs, and the advantages of variations in the position of the member to be examined.

W. S. L.-B.

**Helm.** Der tabische Magen in der Perspektive der Radioskopie. [**The tabetic Stomach under X-rays.**] *Fortschr. a. d. Geb. d. Röntgenstrahlen,* 1918, **3**. 25. [Abstracted from *Zentralbl. f. Chir.*, 1918, **45**, 880.]

Proof is given in 12 cases that in individual cases at different times completely different appearances may be presented. A connexion between the subjective and objective findings with reference to the stomach picture cannot always be determined. Also in cases subjectively similar, sometimes one sometimes another picture is to be found. In the majority of cases marked subjective symptoms are associated with a radiograph deviating from the normal; before everything spastic conditions of the stomach are not to be confounded with true hour-glass forms. Very noticeable are the considerable variations in tonus yielded by the stomachs of individual tabetic patients, where marked atony may alternate with normal tonic behaviour. The atonic stomach indicates a pause in the attack.

W. S. L.-B.

**Simon.** Röntgendiagnostizierte Verwachsungen im Coecaltractus. [**Adhesions in the Coecal tract diagnosed by X-rays.**] *Hygiea* (*Swedish Kirurkiska Sectiones förhandlingar*, 1916–17), 1918, **80**, 241. [Abstracted from *Zentralbl. f. Chir.*, 1918, **45**, 881.]

Two cases of strangulation of the lower end of the ileum due to adhesions following an operation for appendicitis which was performed several years previously. For comparison the author refers to 23 earlier published cases of stenosis of the ileum, in 16 of which there was a history of carcinoma or tuberculosis. Whilst the radiograph showed stenosis distinctly in the latter cases, in the two first mentioned there was no real stenosis, but only a slightly retarded filling of the caecum, together with slight dilatation of the lower coils of the ileum and a noticeable distension with gas. These differences, which can be recognized by means of the rays, make a differential diagnosis possible between neurotic nervous troubles after appendicitis and those due to the actual existence of adhesions. W. S. L.-B.

**Schwarz.** Über Kontrastmehlkonkremente in Dickdarm-Röntgenuntersuchtungen. [**Contrast-meal Calculi after X-ray investigation of the large intestine.**] *Therap. Monats.*, 1918, **32**, 9. [Abstracted from *Zentralbl. f. Chir.* 1919, **46**, 255.]

The author refers to the possibility of the formation of a faecal calculus from the contrast-meal taken for the purpose of X-ray investigation. In one case this caused a moveable, painful tumour in the right lower abdominal region, for which appendectomy was performed. He also refers to the literature, which shows that the wall of the caecum changed by disease is easily affected by coprostasis, and urges that, after a contrast-meal has been given, increased evacuation of the bowels is necessary.

W. S. L.-B.

**Ponzio, M.** Studio radiologico dell' evoluzione dei traumatismi ossei per ferite di guerra ed indicazioni terapeutiche da esso suggerite. [**A radiological study of the evolution of war injuries of bone, with the therapeutic indications suggested thereby.**] *Radiol. med.*, 1919, **6**, 12–25.

Radiological examination is not merely a means of localizing foreign bodies, but its systematic use can give valuable information on the condition of damaged tissues, and so help in guiding treatment and deciding on prognosis. The author discusses at length the lessons derived from an extensive radiological experience in war wounds of bone. The main factor in these war injuries is, he considers, that there are open wounds, and nearly always infection, so that the majority do not recover in the way that is normal in simple fractures. Another difference between cases due to ordinary trauma and to projectiles of warfare, lies in their greater variety and the greater violence applied by the latter. The X-ray picture varies between a hardly visible crack and complete shattering of the bone, and it is hard to establish a proportional relationship between the trauma and the resulting lesion. The governing factors are the force and shape of the missile, the nature and part of bone struck, whether shaft or epiphysis, long or short bone, and on whether a groove, fissure, perforation, true fracture, or shattering results.

**Incomplete fracture forms.** In modern war, furrowing is rare, but can be seen in the epiphysis of large bones and on the surface of the skull and the pelvis. The sulcus has often small fissures radiating from it, but they are not easy to demonstrate in cranial and pelvic bones, though the arrangement of scattered fragments of metal will sometimes suggest their position. Isolated fissures are not common, but can sometimes be seen; when a projectile with small force strikes tangentially, it produces a linear fissure of the surface. The length of fissure depends on the nature of bone more than on the force of the blow; in long bones it may be extensive, and may also be seen at the side opposite to the point of entry. Fractures of the inner table can also be found after small wounds of the head, and explain persistence of symptoms out of proportion to what was expected from clinical examination.

Perforation is rarely seen in simple form. It may be incomplete, and contain a firmly embedded fragment of shell or grenade; more commonly one sees a hole surrounded by radiating fissures, especially at the point of exit.

The course of these incomplete bone lesions is usually good, but much after-trouble may result from laceration of periosteum, leading to the formation of adhesions or bony enlargement, specially when near joints and after infection. The process of bone repair may be retarded by the presence of a foreign body, or by the establishment of localizing osteitis or osteomyelitis. Radiograms show that such process is limited to the region of the wound, and seldom spreads. Repair is slow, and solution of bony continuity can be seen for a long time. Perforation leaves little after-trouble, unless it involves joint surfaces or is complicated by injury to other organs. The former may end with decalcification, rarefaction, ankylosis, which can only be appreciated fully by the X-ray picture.

**Complete fracture** is the more common form of bone injury, and is mostly complicated and comminuted owing to the great force of modern projectiles. X-rays show in most cases, especially in wounds sustained at close quarters, extensive and minute shattering of the bones, characteristic of an explosive type of violence, with dissemination of bony and metallic fragments in the soft parts around. One has wrongly attributed to 'explosive bullets' these results, which are really due to the explosive effect of modern high velocity projectiles at short range. This is proved by examination of captured Austrians and of cases of accidental wounds, which show appearances of an equally explosive type where the use of explosive bullets can be excluded.

The author insists on the necessity of periodical X-ray examination, as the surest means of establishing the nature of the condition present at each stage, and the desirability and extent of operation when indicated. He denounces excessive or hasty removal of bony fragments as a frequent cause of useless and flail joints and bony deformities from deficiency of substance. The patients are young, fit, and of full cellular activity; the bone fragments show vigorous efforts at growth, ejecting useless pieces and binding the rest in callus. The growth may even be excessive, and produce obliteration of interosseus spaces, infiltration of muscle, obstruction at joints, and compression of nerves or vessels. These conditions can be elucidated by radiology alone.

Systematic X-ray examination has thrown much light on the nature of calculus and its formation, and on the treatment of pseudarthrosis and delayed and mal-union of fractures. It is more common to find lack of consolidation of callus than complete absence of new bony growth. Differentiation between fibrous union and false joint is not always easy, as the radiograph does not always agree with the clinical picture. True pseudarthrosis is relatively rare in war surgery.

The process of osteitis goes on in the superficial layers of the bone and spreads, while a reactive and defensive area appears more deeply in the form of compact bone showing no trabecular structure to X-rays. This limits the infective process, but may later on be an obstacle to closure of cavities. If suppuration lasts long, the osseous reactive tissue is less distinct, the zone of osteitis more extensive, and calcareous osteoatrophy becomes evident. The healing of the wound is too often taken as a sign that observation may cease, and bad functional results ensue. These can be prevented by proper X-ray supervision, which will reveal conditions likely to benefit by physical treatment or by surgery, or by avoidance of forcible manipulation where a quiescent focus may be lighted up. In a comparison of many cases the most remarkable functional results were seen when there was a combination of surgical treatment with prolonged and systematic physiotherapy. Among points for consideration here the author says that pain in stumps is less commonly due to neuroma than to neuritis of compression, ischaemia or distrophy of callus, bony spicules, &c., and seldom to foreign bodies. Pain in joints is often due to osteoatrophy, which X-rays show may follow even slight injury with prolonged fixation. The consolidation of callus is not the final stage, bony deformity may progress, and local weakness may exist, so these cases should be watched for a very long time.

Fixation by metal wires or screws or bone-grafts should only be done when deformity is excessive, and then only when sepsis is quite gone. When a graft is succeeding its substance can be seen to be invaded by new bone, in less favourable cases it is quickly isolated by a fibrous wrapping and is left useless.

Non-union is now seldom seen, owing to improved technique, of which X-ray control is an important part. In all this work the radiological contribution needs constant and minute attention, anatomical and pathological knowledge, and cannot be efficiently done by nurses, orderlies, or other subordinates. N. H. M. B.

## RADIO-TECHNIQUE

**Pagenstecher.** Ueber die Filter in der Strahlenbehandlung. [**On the filter in X-ray treatment.**] *Fortschr. a. d. Geb. d. Röntgenstrahlen,* 1918, **3**, 25. [Abstracted from *Zentralbl. f. Chir.*, 1918, **45**, 947.]

The results obtained, with the aluminium filter recommended by Gauss and Lembcke, in cases of deep-seated tumours, were in part unsatisfactory, principally because later damage to the skin was observed, which led to very slow healing. P. therefore tried a heavy metal, above all lead, to take the place of the filter recommended previously. The experiments proved that through a screen of lead of 1 mm. or even 4 mm. thickness quite a good measurable quantity of hard rays could pass.

In conclusion, the combined use of lead and aluminium is recommended, $\frac{1}{4}$ mm. lead and 1 mm. aluminium, the latter being for the avoidance of secondary rays from the lead. W. S. L-B.

**Coolidge, W. D. The radiator type of tube.** *Am. J. Roentgenol.*, 1919, **6**, 175.

This tube operates satisfactorily on a simple transformer, an interrupterless outfit, or an induction coil, and hence is generally applicable for diagnostic work. With an induction coil valve tubes are unnecessary, as the tube is self-rectifying, and with an interrupterless machine the tube is not injured by faulty setting of the mechanical rectifier. It was primarily intended, however, for use with a transformer, and this gives freedom from mechanical and electrical complications and from noise, and diminishes the odours attendant on high tension discharges in air. The first cost of installation is also reduced and portable outfits are possible for use when the patient cannot be moved to an X-ray laboratory. With every current source it permits of the intermittent use of more energy than could be carried safely by the old type of hot cathode tube. In its present form it is not adapted for therapeutic work, for with continuous operation it will carry less than one-fourth of the energy of a seven-inch hot cathode tube.

For a given voltage the current carrying capacity is a very definite quantity. The tube was first designed to carry 10 m.a. at a five-inch spark gap, and a focal spot of one-eighth of an inch diameter was employed. A tube of the same construction with a $\frac{3}{16}$ in. focal spot will carry 30 m.a., and the capacity can be still further increased. The smallness of the focal spot causes the tube to give a well-defined image. A shield has been developed for the tube, completely surrounding it with glass of high lead content, thus protecting the operator. Tests are detailed which show that, running directly from a transformer, without the use of a rectifier, the 30 m.a. tube can be operated for single periods of 35 seconds as compared with a limiting time of 10 seconds with a medium focus, solid tungsten target tube, working under similar conditions. Six-second periods of operation could be repeated indefinitely with 40-second intervals using a radiator tube, while the other type required intervals of from 15 to 20 minutes. J. R. C.

**Lumière, A.** Sur la précision des images radiographiques. [**The precision of radiographic images.**] *J. de radiol. et d'électrol.*, 1918, **3**, 97.

Four rectangular sieves, made of wires of different diameters, were supported 10 cm. above a photographic plate, the anticathode of the X-ray tube being 50 cm. away from the plate, and photographs were taken under different conditions of working. It was found that the focal spot is slowly modified in the course of a long exposure, broadening to an appreciable extent. It also suffers a slight displacement when the tube is run for several minutes. In another group of experiments the current strength was varied from $\frac{1}{4}$ m. amp. to 15 m. amp., the exposure being correspondingly shortened, but the differences in definition were not appreciable. On the other hand, when the tube was softened so that the equivalent spark gap was reduced from 18 cm. to 3 cm., the definition was not so good. Trials with other tubes gave opposite results, and for every tube there appears to be a particular hardness for which the definition is a maximum. It is considered, however, that the variation is not of great importance. Every tube appears to be able to furnish an image, the definition of which depends on the tube, and is little modified by the conditions under which the tube is run. Four photographs taken with the anticathode 30, 50, 100, and 150 cm. from the plate, the exposures varying directly as the square of the distance, show the improvement in definition obtained by increasing this distance.

The experiments only relate to the definition properly so-called; they are not concerned with the degree of contrast obtainable with a tube. For example, a hard tube might give excellent images of all four sieves, but would not be so suitable for examining a case of renal calculus as a softer tube which did not show the finer wires. As the lack of precision seems to result from the surface of impact on the anticathode not being punctiform, but of an appreciable area, two photographs were taken, one with the tube in the normal position and the other with the anticathode nearly perpendicular to the plate. In the latter case the projection of the focal spot on the plate is a thin line, and the images are greatly improved in one direction. It is concluded, therefore, that one of the essentials for the obtaining of a greater precision in radiographs is the reduction of the size of the focal spot. J. R. C.

**Laborde, A.** Appareils employés en radiumthérapie. [**Apparatus employed in radiumtherapy.**] *J. de radiol. et d'électrol.*, 1918, **3**, 106.

This is a general review of the properties of radium and its radiations. Reference is also made to the transformation products of radium. A feature of the paper is a table showing the percentages of soft $\beta$, hard $\beta$, soft $\gamma$, and hard $\gamma$ radiation transmitted by various metals, bone, and some organic substances, when the thickness of the absorbing material varies from 0·1 mm. to 20 mm. J. R. C.

## RADIUM THERAPY

**Becerro de Bengoa.** Technique de la radiumthérapie du cancer de l'utérus. [**Radium Therapy of cancer of the uterus.**] *Annales de la Faculté de Médecine*, 1918, ii, 886. [Abstracted from *J. de radiol. et d'électrol.*, 1918, **3**, 142.]

Supporting his testimony on the treatment of 200 cancers of the uterus treated by radium, the author arrives at the following conclusions:

1. Radium possesses a truly specific action in regard to cancer cells.

2. Vegetative cancers yield more rapidly and are of less serious prognosis than infiltrating or corrosive tumours.

3. Radium often produces pseudo-cures due to an amelioration of the cancer of the cervix, making at the same time an advance in the body of the organ which manifests itself sooner or later.

4. These pseudo-cures are due to an inefficient technique. In fact, if the ideal situation of the radium tube is the cervical cavity, it is nevertheless true that this position can rarely be utilized. More frequently the tube is placed in the vagina, in more or less perfect contact with the external os. The author favours the employment of special thin silver tubes, having four projections on their exterior surface, which prevent them from falling into the vagina. They are placed in position after dilatation of the cervix, and it is then easy to deposit inside these tubes the radium tubes, kept in position by a compress. The cervix and the adjoining tissues are submitted to radiation. There is no danger of cervical occlusion, and all the radiation is absorbed by the neoplastic cells. W. S. L.-B.

**Laborde, A.** Appareils employés en radiumthérapie. [**Apparatus used in Radium Therapy.**] *J. de radiol. et d'électrol.*, 1919, **3**, 153.

Gives a résumé of the properties of the various rays emitted by radioactive matter, and describes the various types of containers and applicators used for treatment with radium salts, emanation, radioactive solutions, &c., together with details of methods used in measuring their activity. F. L. H.

## ELECTRO-DIAGNOSIS

**Jaulin (d'Orléans).** Une observation de syndrome du carrefour condylo-déchiré postérieur. [**Observations on a case showing the complete syndrome of the four last cranial nerves.**] *Arch. d'électric. méd.*, 1919, **438**, 65–71.

This syndrome is produced by a unilateral traumatic lesion of the glossopharyngeal, vagus, hypoglossal, and spinal accessory nerves, which is rendered possible by the fact that they emerge from the base of the skull in such close proximity that a single projectile may injure them all. In addition, there may be involvement of the sympathetic, and also of the superficial cervical plexus. Such a lesion can be studied clinically only by the merest chance, especially when due to a wound on the battlefield, as the same wound nearly always destroys the internal jugular and carotid vessels and leads to death.

The author was fortunate in having had the care of one of the rare survivors from such a wound, whom he examined radiographically, electrically, and clinically. The patient, a healthy sergeant and priest, aged 31, was wounded on July 24, 1918, by a piece of shell which entered the left pinna, passed between the ascending ramus and the mastoid process, and reached the anterior pharyngeal wall a little to the right of the middle line, and just above the level of the articulation between the second and third cervical vertebrae. There was immediate loss of speech, and haemorrhage by the nose and mouth; he became weak and was soon carried to the aid-post. There he could not drink 'because he swallowed crooked'. The disphagia and aphonia persisted till October, when both disappeared. He was treated at Marseilles and Pau (15th region) before coming under the observation of the author in December. Early and late radiographs agreed in localization of the foreign body. Electro-diagnosis in the 15th region on Oct. 26 showed:

Left spinal accessory nerve—sterno-mastoid and trapezius—complete R. D.

Left hypo-glossal nerve—Lingual and omo-hyoid muscles—complete R. D., while in the 18th region, by the author, on Dec. 27, the result was:

Left sterno-mastoid and clavicular head of trapezius—no response.

Remainder of trapezius—very weak normal response.

Left lingual muscles—complete R. D.

An attempt to test the pharyngeal constrictors, under cocaine, was too painful to pursue, but seemed to show a Faradic response.

The clinical picture showed:

(1) Retraction of left palpebral fissure, enophthalmos, myosis.

(2) Left hemiatrophy of tongue.

(3) Left shoulder dropped and displaced forwards, atrophy of upper part of trapezius.

(4) Obliquity of head—vertex to right, chin to left, chin rotated to left.

Speech—Bi-tonal voice, patient had to take breath after every few words.

Laryngoscopy—showed paralysis of left recurrent laryngeal nerve.

Tongue—diminished tactile sensation at the V, and much diminished, if not absent, sense of taste.

All the above are signs referable to the four last cranial nerves and the sympathetic.

There was also some wasting of the middle and lower portions of the trapezius, and much neuralgic pain from occiput to shoulder.

The author propounds, without answering, the problem—Was this due to direct injury to the superficial cervical plexus, or to secondary neuritis due to the connexion of the vagus hypoglossal and sympathetic with the cervical plexus? N. H. M. B.

## ELECTROTHERAPY

**Gros** and **Fromaget**. Action analgésiante du courant faradique faible en thérapeutique oculaire. [**The Faradic Current in treatment of the Eye.**] *Clin. ophthalmolog.*, 1919 (Jan.), **32**. [Abstracted from *Arch. d'électric. méd.*, 1919, **27**, 53.]

The authors utilize the Faradic current proceeding from a portable coil on a Gaiffe carrier, with a rapid interrupter actuated by four Leclanché cells whose current is regulated by a rheostat. The painful region is covered with damp compresses on which is placed either a large plate of malleable metal or a carbon plug; the other pole is fixed to a metallic handle held in the hand. The electrification should only last from two to three minutes; if the hoped-for result is not obtained in that time, the probability is that it would not be obtained by prolonging the treatment. The authors quote 11 observations, among which are several cases of supra-orbital herpes zoster, cured after two or three applications, and one case of sciatica cured at the end of two days. W. S. L.-B.

# MEDICAL SCIENCE

## ABSTRACTS & REVIEWS

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# REVIEWS

## INFLUENZA

**Epidemiology.** Frost points out that the special characteristics of influenza epidemics are their wide and rapid extension, their high attack rates, and their great effect upon general mortality rates. In the intervals between epidemics influenza becomes inextricably confused with other respiratory diseases, so that the record of prevalence and even of mortality is virtually lost. The first requisites for epidemiological study, namely, clear differential diagnosis and systematic records of occurrence, are therefore lacking in influenza. The nearest approximation to a record of influenza is furnished by statistics of mortality from the group comprising influenza and all forms of pneumonia. In British cities, as shown by the weekly return of deaths in London and 95 other large towns in England and Wales, the epidemic of 1918–19 showed three distinct waves —the first and slightest in point of mortality in June and July, the second and most severe in November, and the third in February and March. The course of the epidemic in Western Europe was similar. In the cities of India the sequence was similar, but the mortality far greater. In the United States, where the epidemic developed more largely in a single wave during September, October, and November, the curves of mortality differed widely in different cities. The total number of deaths attributable to the epidemic in the civilian population of the United States was estimated at not less than 450,000, or more than 4·0 per thousand.

According to Hamer, in his report to the London County Council, deaths in London certified as caused by influenza numbered 894 in the summer of 1918, in the autumn 11,336, and in the winter 3,278. Allowing for excess mortality due to other causes, it seems probable that the first wave caused some 1,750, the second about 16,000, and the third about 5,000 deaths. In the County of London 23 per cent. of the total mortality in the third quarter of 1918 was borne by the age group 15–25 among females, 15 per cent. being the proportion for males; 19 and 12 per cent. are the corresponding proportions in the last quarter of 1918. In females more than half, and in males nearly half, the mortality occurred among persons aged 15–45.

A comparison between the epidemic of 1889–90 with that of 1918 as regards the mortality at different ages is furnished by the statistics of the Life Insurance Bank at Gotha which are published by Florschütz. During the epidemic of 1889–90 no death occurred in the age period 15–30, and only a few from 30 to 60, and it was not until old age that the deaths become more numerous. In 1918, on the other hand, the percentage of deaths between 15 and 30 was only exceeded by that in advanced old age (81–90). Between the two extremes there was a fall in the mortality which reached its lowest point between the ages of 51 and 60.

In a comparison of the epidemic of 1918–19 with that of 1889–90, Conner states that the virulence of the former was unquestionably greater. In 1918 a larger proportion of the population seems to have been attacked, the incidence of pneumonia was greater, and its mortality was also somewhat greater. Examples of the so-called cerebral and gastro-intestinal forms have been so rare in the recent epidemic as to raise the question as to the propriety of such a classification, the respiratory form being the only one represented.

Bahrdt, physician to the Leipzig Life Insurance Society, brings forward the following reasons to show that the mortality from influenza in Germany was not affected by the scarcity of food caused by the blockade: (1) It was not so much weak old people who succumbed, as was the case in the epidemic of 1889–90, although they suffered most from the scarcity of food, but the mortality was highest among the young who were better able to digest war diet. (2) Among 108,922 persons insured by the Leipzig Insurance Society 10,542 were living in Switzerland, among whom the mortality was 6·72 per thousand, although food was not nearly so scarce as in Germany and Austria, while the mortality among the remaining 98,379 was 1·96 per thousand. (3) The mortality among persons insured by the Leipzig Insurance Society in 1889–90 was 1·45 per thousand; in other words, at a time when there was no food scarcity it was almost the same as at present.

**Bacteriology.** Arkwright criticizes the claims made by Bradford, Bashford, and Wilson to have discovered and cultivated the filter-passing virus of trench fever and influenza (vide *Medical Science*, 1919, **1**, 40), and considers that the forms regarded by these observers as the virus of these two diseases are of two kinds: (*a*) bacteria of the size of a staphylococcus or diphtheroid bacillus but only partially stained (polar or central staining); (*b*) smaller or larger granules of precipitated protein which are also found in control tubes. In a note appended to Arkwright's article Bradford and Wilson admit that it has not been proved that a filter-passing organism has been grown in any of the diseases for which a claim was made.

In 260 cases of influenza reported by Schorer *B. influenzae* was isolated in 242 instances, or in 93·8 per cent. Out of 81 uncomplicated cases 73, or 91·5 per cent., were positive. Influenza bacilli were found in every one of the 135 complicated cases, and of 44 convalescent cases 34, or 77·3 per cent. were positive. Cultures from the naso-pharynx gave a higher proportion of positive results than did those from the nose. Oleate or Castile soap-haemoglobin-agar was found to be by far the most favourable medium for the isolation of *B. influenzae*.

Messerschmidt, Hundeshagen, and Scheer found Pfeiffer's bacilli in 48·9 per cent. of their cases in June and July, and in 90 per cent. of their cases in September and October 1918, whereas cultures from healthy persons and other diseases proved negative. The diagnosis of influenza bacilli was made from their morphological appearances and exclusive growth in media containing haemoglobin. The writers consider that the presence of influenza bacilli is absolutely characteristic of influenza and that there is no reason at present for disputing their aetiological significance. In a postscript they add that they had several times found influenza bacilli in the kidneys, liver, and lungs *post mortem*, when the necropsy was made a few hours after death.

In a study of influenza pneumonia at Camp Greene, N. C., Brown and Palfrey found that the pneumococcus or streptococcus or both were present in a large proportion of all cultures made from cases clinically diagnosed as influenza. The complications were due almost entirely to the pneumococcus. Lobar pneumonia was the cause of death in 72·35 per cent. of the cases. Type determination in 444 cases of pneumonia showed pneumococcus type I in 25·5 per cent, type II in 17·1 per cent., type III in 19·1 per cent., type IV in 22·7 per cent., more than one type in 9·3 per cent., and undetermined including streptococci in 6·3 per cent.

**Symptomatology.** Bloomfield and Waters made repeated X-ray examinations of the lungs during the course of clinically uncomplicated cases of influenza, but found only permanent lung markings unassociated with the acute disease. In no case was any shadow seen which could be interpreted as indicating a solidification of the lung. These results are in favour of the view that broncho-pneumonia is a complication and not an essential feature of the disease.

Stewart and Flint report a case of acute infective **endocarditis** of the aortic valve coming on rapidly in a man, the subject of an old aortic lesion and ending fatally within three days of the onset of acute symptoms. Its chief interest lay in the fact that the causative organism was a Gram-positive pleomorphic diplococcus very similar in its morphological and cultural characters to that described by certain writers in connexion with the influenza epidemic (vide *Medical Supplement*, 1918, **1**, 307 *a* ; 354 *a*, *et seq.*).

In an article on **heart-block and bradycardia** following influenza, Cockayne (1) states that in cases of simple influenza, and in many with pulmonary complications, bradycardia was extremely common among the patients admitted to the Royal Naval Hospital, Haslar, in 1918 and 1919. In 19 out of 55 cases in which polygrams were taken the bradycardia was shown to be due to a condition of partial heart-block. The cases of heart-block observed were: sinus-block (1 case), prolongation of the *a–v* interval (2 cases), 2 : 1 heart-block (9 cases), 3 : 1 heart-block (6 cases). No case of complete heart-block was observed. Most of the cases of heart-block occurred in young men and were complicated by pneumonia, which in most was very mild and in none very severe. All the patients were kept in bed until the heart-block disappeared. 113 cases of simple bradycardia were observed, the majority of which also occurred in young men. In almost all some involvement of the lung was present. Cockayne considers it probable that heart-block and simple bradycardia are both due to the same toxin.

In his thesis on influenzal **phlebitis** Lemaire states that this complication may occur during the course of influenza or in convalescence. It appears to be more frequent in complicated or prolonged attacks, though it may sometimes develop in mild cases. It seems to be due less to the unknown organism of influenza than to secondary invaders (pneumococcus, streptococcus, pneumobacillus, &c.). In Lemaire's experience the prognosis is relatively favourable. It is frequently bilateral. It is attended with only a moderate degree of oedema, the pain rapidly disappears on immobilization, and embolism of any kind is exceptional. Conner, on the other hand, has seen an unusually large proportion of cases of thrombophlebitis which were associated with fatal pulmonary embolism. Faure has had a similarly unfortunate experience. During the epidemic of influenza in the first three months of 1919 he was impressed by the frequency of embolism among the cases on which he had operated, seven cases occurring in as many weeks. Henceforward he is determined not to perform any important operations during a serious epidemic of influenza.

In the Paris thesis Exintaris remarks that **haemorrhages** in influenza are specially frequent in epidemics. As a rule they occur as symptoms rather than complications, and affect all organs, including the skin and mucous membranes. During the epidemics of 1918–19 they were chiefly represented by epistaxis, metrorrhagia, and haemoptysis, which were much more frequent than in the epidemic of 1889–90. On the other hand, in 1890 there were numerous instances of haematuria and of intestinal, ocular, and aural haemorrhage, which have been exceptional in the present epidemic.

Chopinet, who has chosen the same subject for his thesis, distinguishes the haemorrhages met with in influenza according as they occur at an early or late stage. Epistaxis and menorrhagia have been observed so frequently during the first few days of the disease in the recent epidemic as almost to constitute an initial haemorrhagic syndrome which does not possess any prognostic significance, although its diagnostic value is considerable. The late haemorrhagic forms similar to those met with in certain infectious diseases have been less common, but haemoptysis occurring at the height of the disease is one of the principal symptoms characteristic of a pulmonary complication. It may sometimes render the diagnosis doubtful, especially as it sometimes indicates the activation of a dormant tuberculosis.

Portmann records a case of **cancrum oris** in a previously healthy man aged 43 which developed in convalescence from influenzal broncho-pneumonia. Bacteriological examination showed staphylococci, streptococci, and pneumococci in the lesion. Recovery followed excision by the thermo-cautery.

Bohmansson records a case of **acute dilatation of the stomach** in a man aged 22 admitted to hospital with influenzal pneumonia. The symptoms, which consisted of vomiting and epigastric pain, first developed on the eighteenth day of illness, shortly after the temperature had begun to fall by lysis. There was a well-defined tender swelling in the left side of the abdomen extending from the ribs to the pubes. On laparotomy an enormously distended stomach was found, occupying almost the whole of the abdominal cavity. A Witzel fistula was made in the stomach and the abdomen closed. Death took place on the sixth day after the operation with signs of acute peritonitis. The necropsy showed bilateral broncho-pneumonia, fibrino-purulent peritonitis, and a phlegmonous condition of the operation wound.

In two fatal cases of influenzal broncho-pneumonia reported by Nicolaysen in which diplostreptococci were found in the lungs the duodenum presented an ulcer, the histological appearances of which showed that it was acute in origin. In neither case had there been any history of dyspepsia. From the floor and walls of the ulcer the same organisms were isolated as had been found in the lungs. Similar cases of gastric and duodenal ulcers of infective origin were described by Rosenow in 1916.

In an article on the involvement of the **suprarenal glands** in influenza and influenzal pneumonia Cowie and Beaver state that in 6 out of 11 necropsies hypoplasia was found, and in one moderate atrophy, but in no cases did haemorrhage into, or necrosis of, the suprarenals occur. The chief symptoms of suprarenal insufficiency, such as asthenia, prostration, and lowered blood-pressure, were invariably present, and a characteristic rise of blood-pressure followed the prolonged administration of epinephrin. Endocrinal disturbance in influenza and influenzal pneumonia was further suggested by a prolonged blood sugar curve after injection of epinephrin as well as after ingestion of glucose. Hypoglycaemia, on the other hand, was not present in influenza and influenzal pneumonia, as has been found in some diseases of endocrinal origin. Intramuscular injection of epinephrin was of little if any benefit therapeutically, but the writers add that the proper mode of administering epinephrin in suprarenal insufficiency has not yet been found.

**Ear, nose, and throat.** In a paper on affection of the nasal accessory sinuses and middle ear in influenza Prym states that out of 92 cases examined *post mortem* at the Bonn University Pathological Institute, in only 21 was the sphenoid sinus found to be completely normal. In 71 cases it showed changes varying from a slight redness to suppuration. There was, therefore, an involvement of the sphenoid sinus in about 77 per cent. As in Fraenkel's cases (vide *Medical Science*, 1919, **1**, 47), the condition found was mainly an exudative process. In more than half the cases the sphenoidal sinus contained pus or muco-pus. Bacteriological examination was made in 47 cases, 22 of which were sterile, while the remaining 25 showed pneumococci, Gram-positive diplococci, staphylococci, influenza bacilli, or streptococci. The upper nasal cavities were examined in 48 cases, 25 of which showed changes varying from slight redness to suppuration, always corresponding to the lesions in the sphenoidal sinus. The frontal sinuses were examined in 33, in 10 of which the changes were similar to those found in the sphenoidal sinus. The middle ear was examined in 88 cases and changes were found in 28 : in 2 chronic otitis media, and in 26 acute lesions, varying from slight redness of the drum and mucous membrane to suppuration. The findings in the middle ear corresponded with those in the sphenoidal sinus, the sphenoidal sinus being intact in only 3 cases of acute otitis media.

In an article on the aural and nasal complications of the recent epidemic in children, Abrand states that otitis, which was extremely frequent in children in the course of small epidemics of influenza between 1905 and 1914, was relatively rare in the recent epidemic until it began to decline, when numerous cases of severe otitis occurred. Suppuration took place rapidly, and paracentesis was required at once. Another complication, which is usually uncommon in children and has since become more frequent, is acute purulent ethmoiditis, which is manifested by a profuse discharge of pus or muco-pus and a widening of the upper part of the nose with or without pain on lateral pressure. As a rule the condition clears up very well when left to itself, but there is great risk of chronic ethmoiditis ensuing. Another frequent manifestation of influenza in children in the recent epidemic is glandular fever, which is characterized by a soft enlargement of the cervical glands, with moderate fever and gastric disturbance.

Peretti-Griva records the case of a woman aged 38 whose attack of influenza was complicated by suppurative adenitis of the glands situated at the level of the upper part of the trachea. Symptoms of severe laryngeal stenosis developed, but recovery took place as the result of spontaneous rupture of the abscess into the oesophagus.

A fatal case of suppurative mediastinitis due to ulceration of the third, fourth, and fifth tracheal cartilages is reported by Peregrine in a man aged 24 following influenza. There was no obstruction to respiration, which was due to the fact that there was no oedema of the glottis or tracheal mucous membrane.

**Skin.** Cockayne (2) records three cases of acute striae atrophicae following influenzal pneumonia in seamen aged 18. In all three the striae were bluish red in colour and depressed below the surface of the neighbouring skin. In no case was any pain complained of. In one case the striae were unilateral and confined to the diseased side; in one they were symmetrically placed on both sides, though the disease was much more severe on the right, and in the third they were much more marked on the side on which the pneumonia had been worse. Although Cockayne had seen some hundreds of cases of influenzal pneumonia in young men aged 18 or 19 during 1918 and 1919 these were the only cases in which striae atrophicae were observed. He attributes their production to three factors: (1) An inherent weakness of the elastic fibres of the skin. (2) A toxin which still further weakens them. (3) Traction on the skin which causes their actual rupture. The case with most of the striae was nursed in the prone position, and two in whom the striae were low down were nursed propped up in bed.

Among the rarer complications of influenza mentioned by Conner, who states that a few examples of it were found in almost every camp in the United States, was extensive **subcutaneous emphysema.** It was usually seen in cases of severe pneumonia, and appeared first either in the episternal notch or above the clavicles, extending thence rapidly to the neck, face, scalp, chest, arms, and trunk, and sometimes to the scrotum. The prognosis in such cases seemed to depend rather on the severity of the pneumonia than on the existence of emphysema. The condition was proved not to be due to gas infection. In most cases the air finds its way to the subcutaneous tissue by rupture of the air vesicles and by passing thence along the vessel sheaths to the hilum of the lung and superior mediastinum. Six instances of subcutaneous emphysema were also seen by La Fétra in his broncho-pneumonia cases in children. It occurred only in the severest cases, as five out of the six died.

**Nervous and mental complications.** Robey and Caro report two fatal cases in adults, aged 22 and 26 respectively, one of acute myelitis and the other of polyneuritis following acute respiratory infection, which was probably influenzal in character.

Speidel describes four varieties of encephalitis occurring in influenza: (1) The ordinary uncomplicated form. (2) Encephalitis accompanied by somnolence. (3) A form characterized by rigidity, the clinical picture resembling paralysis agitans sine agitatione. The trunk, and especially the head, are inclined forwards, the arms slightly flexed and abducted, the movements stiff, and the eyes staring. (4) Encephalitis associated with psychical disturbance. Speidel admits that this classification is only schematic, as somnolence and rigidity or somnolence and psychosis may be associated in a single case. He concludes that the forms described are not independent diseases, and that it is not necessary to speak of a lethargic or catatonic encephalitis, as they all belong to the same clinical picture of influenzal encephalitis, but suggests that the individual symptoms are possibly associated with a varying localization of the foci.

The subject of influenza as a factor in precipitating psychoses and initiating psychoses is discussed by Harris in a paper based on the study of 18 cases observed by him at the Worcester State Hospital, Massachusetts. He found that the psychoses bore no relation to the character of the influenzal attack, being liable to occur after mild as well as after severe attacks. The symptoms in most cases developed in less than two weeks after the febrile period, but in some cases might not appear for three months. Delusions and hallucinations were the commonest symptoms seen in the writer's series, being present in 10 cases. Depression was the most pronounced symptom in only three cases, whereas excitement and destructive tendencies were present in 14. Although any form of psychosis may result, dementia praecox was the commonest in this series, being found in eight cases. The average ages of the patients so diagnosed was 27 years.

According to Menninger a considerable number of instances of neurosyphilis appearing after influenza occurred at the Boston Psychopathic Hospital. In practically all the cases there was close chronological association of the influenza and the appearance or aggravation of the mental symptoms. Menninger reports 10 cases which he classifies in the following four groups: (1) Cases in which there were no symptoms of neurosyphilis whatever until after the attack of influenza. (2) Cases in which the previous symptoms were trivial and not diagnostic, but in which typical and advanced neurosyphilis developed immediately after influenza. (3) Cases in which the previous symptoms were diagnostic of mental disease (nervous syphilis) but were intensely aggravated by influenza. (4) Cases in which the clinical manifestations and course were not perceptibly influenced by influenza. Cases of neurosyphilis improved by influenza, of which some instances have been reported, were not observed. The latent, incipient, and early cases of neurosyphilis seemed to be aggravated by the added neurotoxic effects of influenza, but the advanced cases were not usually perceptibly altered in symptomatology or course.

Two rare **surgical complications** of influenza are reported by Gargano, one a case of suppurative orchitis in a man aged 35, and the other an instance of bilateral mastitis in a woman aged 29, which subsided without suppuration.

**Influenza in children.** La Fétra points out that though the mortality in children was very low compared to that among young adults, and especially compared to that among pregnant women, children of all ages contracted the disease, and pneumonia and broncho-pneumonia were common and often fatal complications in all the severe cases. The truth of this statement is borne out by the fact that during the months of October, November, and December 1918, over 900 cases of influenza were treated in the Children's Medical Division of the Bellevue Hospital, New York. The great majority of these patients were not very ill, only about 10 per cent. had pneumonia or broncho-pneumonia, and of these about half proved fatal, the deaths being nearly all among the cases of broncho-pneumonia. La Fétra suggests that the generally lower mortality among children is due to their being sent to bed at once instead of trying to fight the disease.

Rackemann and Brock draw attention to the following **resemblances between influenza and measles** in order to stimulate further study on their aetiology. Both diseases occur in epidemic form and are very highly contagious. Their clinical course is similar: both diseases have a sudden onset, with fever of high degree and short duration. In the acute stages the upper respiratory symptoms with coryza, lacrymation, and an aggravating unproductive cough are alike. The occasional faint evanescent rash in influenza is often suggestive of measles. Both diseases have a low leucocyte count. The greatest similarity, however, lies in the predisposition of patients to develop secondary infection of the lungs and pleura.

**Morbid anatomy.** Polettini carried out 50 necropsies on cases of influenza at the Pathological Institute of Pisa University from September to November 1918, and came to the following conclusions: (1) The lesions in pure cases of influenza, i.e. those in which the clinical picture is not affected by previous or concomitant disease, are well defined and constant. (2) The lesions are characterized by confluent bilateral haemorrhagic bronchopneumonia of the base of the lung; congestion of the cerebrospinal axis with perivascular haemorrhages due to diapedesis of varying distribution but most frequently found in the internal capsule, centrum ovale, and medulla, with fatty degeneration of the vascular endothelium: congestion, haemorrhages, and degeneration of the kidneys, liver, pancreas, and often of the heart, rectus abdominis, and suprarenals, where the lesions range from microscopical haemorrhages in the parenchyma to apoplectic conditions. (3) These lesions are in themselves sufficient to constitute the anatomical basis of the clinical symptomatology of influenza and especially of its nervous and suprarenal syndrome.

Out of 126 cases of influenza observed by Lucke, Wight, and Kime occurring in previously healthy soldiers 5 represented the chronic type. The duration of the disease in these cases averaged 60 days. All of these patients were markedly emaciated. The intense post-mortem lividity encountered in the acute cases was absent. The serous membranes were frequently involved. Thus pericarditis was present in 1, peritonitis in 3, and partially organized pleural exudate in every case. The organs generally presented more pronounced parenchymatous degeneration than in the acute cases, but haemorrhages and marked congestion were absent. The heart always showed cloudy swelling and hydropic degeneration. In the lungs there were pneumonic processes of old standing, the average duration being 44 days. Fibrosis, carnification, atelectasis, and abscesses were common, but there were always recent fibrino-catarrhal areas. The spleen was generally smaller than in acute cases, and in two instances contained large numbers of polynuclear cells. The changes in the suprarenals and semilunar ganglia were similar to those seen in acute cases. The kidneys showed pronounced glomerular nephritis. In two instances an acute suppurative hepatitis with numerous focal necroses was present. The meninges and brain showed degenerative changes similar to those found in the acute cases, but the vascular changes were slight.

**Prophylaxis.** During October and November 1918, Pozzato was in charge of a convalescent hospital for malarial soldiers who were all taking 6 grains of quinine daily in a district where the epidemic was of a very severe type. A large number of mild cases of influenza occurred, which were always cured by three or four days' rest in bed, but there were only three instances of influenza complicated by broncho-pneumonia. Pozzato, however, does not believe in the prophylactic value of quinine, but attributes the relative immunity of malarial patients to a special organic condition resulting from malaria. But it is not only among cases of malaria that this relative immunity to severe forms of influenza is seen. Taddei of Siena (vide *Medical Supplement*, 1919, **2**, 75 *a*) had also found that none of his cases with infected wounds contracted the disease, although a severe form of influenza was present in the town, and that it occurred exclusively in those whose wounds were aseptic or already cured. Taddei's observations prompted Pozzato to make an inquiry into the prevalence and fatality of influenza among the surgical and tuberculous cases in various hospitals in Milan. He found that it was exceptional for influenza to assume a malignant course in patients who were debilitated by an actual or recent illness.

That quinine does not possess any preventive action against influenza was conclusively proved by Ronzani, who had two pastilles of quinine given twice daily for a fortnight to 700 nurses attached to the Milan hospitals, and found that during the administration of the drug the number of cases among them actually increased. The immunity of malarial patients during quinine treatment described by Betti (vide *Medical Supplement*, 1919, **2**, 168 *a*), Cameraro, Vico (vide *Medical Science*, 1919, **1**, 51), and others, he agrees with Pozzato in attributing to a special organic condition produced by the pre-existing disease.

Rosenow and Sturdivant report the results obtained by the use of a vaccine composed of pneumococci types I, II, and III, 30 per cent.; pneumococci type IV and the allied green-producing diplostreptococci, 40 per cent.; haemolytic streptococci, 20 per cent.; and *Staphylococcus aureus*, 10 per cent. The incidence of influenza, of acute oedema of the lungs, of pneumonia following influenza, and the number of deaths from all causes among the vaccinated, were consistently lower than among the unvaccinated. Moreover the incidence of disease and death was lowest in a group of 93,476 persons who were vaccinated three times. The average incidence of influenza and pneumonia in this group was about one-third that in the uninoculated group. The average mortality rate in the uninoculated approximated the mortality rate (5·4 per cent.) of 16 large cities in the United States, whereas the average mortality rate in the group inoculated three times was about one-fifth that of the uninoculated. A definite though smaller degree of protection appeared to be afforded to those who had been inoculated once or twice. In a series of 749 hospital cases of influenza it was found that the tendency to the development of pneumonia in the vaccinated was about one-third as great as among the vaccinated, and the mortality in the former was about one-fifth of that in the latter.

**Treatment.** Herrick remarks that the utter lack of uniformity of drugs recommended is the best proof that there is no remedy of sovereign value in influenza, and refers to the catalogue of remedies advocated by various foreign writers whose papers are abstracted in the *Medical Supplement*, 1919, **2**, 168-9. The remedy which he found of greatest value was digitalis given before alarming indications of failing heart developed, and next to digitalis opium, which, in the form of $\frac{1}{6}$ grain of morphia, was of special value in the case of constant cough and pleuritic pain.

Stoll treated 56 patients suffering from influenzal pneumonia, in 70 per cent. of whom the prognosis was very poor, with the blood or serum of convalescent patients. The mortality among the cases so treated was 45 per cent. 12 cases were treated within 48 hours after the development of the pneumonia and all but two recovered. 32 had been ill for an average of 3–9 days when treated, and 72 per cent. showed distinct improvement. Of 24 patients who had been ill 3–4 days when treated 17 per cent. showed improvement. Although too few cases were treated with convalescent influenza serum to warrant definite conclusions, Stoll's impression was that it was less potent than convalescent pneumonia serum but of more value than normal serum.

Holst treated 20 cases of influenzal pneumonia with intramuscular injections of serum from convalescents from post-influenzal empyema. The treatment appeared to have a decidedly good effect in 10 cases, in which the crisis occurred on the day after the injection of serum. In the other 10 cases there was no obvious effect; 7 of them died, 2 of them only a few hours after the injection.

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## MALARIA

**Epidemiology.** In an introduction to the Local Government Report, dated June 1919, on cases of malaria contracted in England in 1918, Buchanan states that the total number of locally contracted cases notified or discovered by special inquiry since September 1917 now amount to 330, of which 38 were in the Navy, 224 in the Army, and 68 in the civilian population. 238 of these cases seem to have been contracted in 1917, and 99 in 1918. Information showed that in 1918 there was actually a slightly greater number of separate foci of new cases than in 1917, but that fewer cases arose in each focus. All the locally contracted cases so far reported in England have been infections with the benign tertian parasite (*Plasmodium vivax*).

Most of the patients infected in 1917 had a relapse either a month or six weeks after their primary attack, but from October relapses became very rare until April and May, when their number increased. In all the indigenous cases relapses were less frequent and less severe than is usual in cases contracted in the tropics.

During 1917 and 1918 malaria of indigenous origin occurred in the following counties: Kent, Essex. Surrey, Dorset, Suffolk, Norfolk, Sussex, Lincolnshire, Leicestershire, Nottinghamshire, Salop, Hampshire, and Hertfordshire; but a considerable spread of the disease only occurred in Kent, where evidence was obtained that there remain a few areas in England where endemic (true indigenous) malaria still persists. In the Army the origin of practically all the locally contracted cases was attributable to the presence in their immediate neighbourhood of relapsing cases of malaria among soldiers returned from Eastern areas, especially Salonica. The sources of infection in the Naval cases seem to have been partly returned soldiers and partly an endemic pre-war form of malaria in the district. In the civil population the source of infection was usually relapsing cases among returned malarious soldiers, but an outbreak in Queenborough in Kent included some cases which seemed attributable to infection not from military foci but from civilian cases in the neighbourhood. The clinical symptoms in these cases were less severe than those of cases which had been traced to an origin of military foci. Lastly, at certain English ports during 1917 and 1918 a potential source of infection was provided by the crews and passengers of transports and merchant ships which had called at ports on the West Coast of Africa where malaria was exceptionally prevalent and severe during the war.

Of the three anophelines, *maculipennis*, *bifurcatus*, and *plumbeus*, which are present in England, *maculipennis* is believed to have been the species responsible for all the cases in which an inquiry in this respect was made.

In a paper on the risk of spread of malaria in relation to demobilization James maintains that in England the factor which determines whether new cases of malaria will occur in a potentially malarious district or not, and the extent to which the disease will spread, is neither the abundance of anophelines in the locality generally nor of carriers, but the degree to which there is close and continuous association between the malaria carrier, the anopheline, and the susceptible person. Such association is only likely to occur in the dark, ill-ventilated houses which the *maculipennis* chooses as its permanent resting and feeding place.

At a meeting of the Society of Tropical Medicine and Hygiene Macdonald stated that the last previous recognition of malaria in epidemic form in England was in the years 1857–1859. In 1856 and later years there was evidence of large importation of ague from Eastern Europe. The coincident abnormal elevation of temperature in the summers of 1857, 1858, and 1859 enhanced infectivity and recognized epidemics occurred. The disease quickly disappeared after 1860 when the summer temperature declined. Tänzer and Osterwald discuss the probability of the spread of malaria in Germany as the result of the rapid demobilization and consequent distribution of numerous cases of chronic malaria over the country, and conclude that though such a contingency is possible the anopheles plague can be considerably reduced by providing bright, well-ventilated, and clean stables, the mosquitoes being found in abundance in dark, ill-ventilated, and dirty places, and being almost entirely absent in hygienic surroundings.

According to Arnsperger foci of malaria were present in Germany even before the war, especially at the mouths of the Weser, Jade and Elbe, and in the North Sea marshes, particularly in the neighbourhood of Emden. But the disease had lost the importance it once possessed in Germany. In the army the number of malarial cases was 132 per 1,000 in 1860, and only 0·07 per 1,000 in 1907–8. Although all the factors of malaria are present to a varying degree in Germany, viz. carriers, mosquitoes, and the optimum temperature, Arnsperger does not think that there is any danger of a wide dissemination of the disease. In support of this view is the fact that hitherto only a few cases of transmission of malaria have occurred, although there have been a great number of cases in the army since 1915, and large malarial centres built in at least 40 places, and no means taken to ascertain whether the places in question were free of malaria and mosquitoes before establishing the centres. The short period during which a suitable temperature for the development of plasmodia lasts prevents their dissemination to the same extent as in southern countries. Moreover, mosquitoes do not occur in such swarms in Germany as in malarial countries, and the population is not indifferent to the dissemination of these insects.

In his paper on malaria on the Western front Böhme states that, out of 768 cases, 241 had already had an attack on the Eastern or South-Eastern front, while 527 were admitted to hospital with a first attack. As regards the source of infection he thinks that the possibility of the disease being contracted on the Western front must be allowed, as the occurrence of anophelines in several places had been reported there. On the other hand, only 30 of the 527 men had been all the time on the Western front, and 10 of them had been in Flanders, while all the rest up to August 1917 or later had been in malarial districts on the East or South-eastern fronts. It is therefore most probable that the great majority of the patients had contracted a latent infection in the East which was roused into activity in the hot season. Benign tertian parasites were found almost exclusively, and the clinical picture corresponded to benign tertian, although at least 100 of the 241 cases who had previously contracted malaria stated that they had formerly had malignant tertian. Arnsperger is also sceptical as to the likelihood of malaria being contracted on the Western front. Among many thousands of patients he has not found a single case in which the evidence of infection having been contracted on the Western front was convincing. He has on several occasions found cases where the disease had remained latent for two years, and thinks it possible that it might remain quiescent for a longer period still.

Burdin, in his Lyons thesis, reports 22 cases of autochthonous malaria observed at Epernay, the patients never having been abroad nor, with one exception, inhabited a malarious district in France. The attack in each case was benign tertian, *Plasmodium vivax* being found in the blood. The disease yielded readily to quinine, and no complications or relapses occurred. The infection was contracted either by a fortuitous association of the conditions necessary for the development of malaria, viz. the presence of anophelines and carriers, and fatigue, or by contamination in a malarious zone created or roused into fresh activity by war conditions.

Neveu-Lemaire and Zemboulis record three cases of malaria in French soldiers who had never left France or been in a malarial district but had been infected by contact with malarial subjects (colonial troops). The attack in two cases was benign, and in the other malignant tertian. One of the three soldiers also contracted amoebic dysentery.

After alluding to Flebbe's paper on malaria in the Taurus (vide *Medical Science*, 1919, **1**, 63) Bentmann relates his own experiences in that region, where he had been in charge of a laboratory. From March 15, 1917, to January 31, 1918, out of 1,214 cases of malaria no less than 1,064 or 87·6 per cent. were malignant tertian, 141 or 11·6 per cent. were benign tertian, and 7 or 0·57 per cent. quartan. The severity of the cases was shown not only by the clinical symptoms but also by the relatively high mortality. In the Turkish military hospitals on the lines of communication from August 1, 1917, to July 31, 1918, 208 out of 2,758 cases of malaria, or 75·4 pro mille were fatal. The mortality for the first six months of the malaria season was 89·9 pro mille. Bentmann is of opinion that widely disseminated as malaria is in Asia Minor, Syria, and Palestine, in hardly any other district are such numerous and severe cases to be found as in the Taurus, and in no other region is the danger of infection so great. The frequency and severity of malarial infection is to be explained by the exceptionally favourable epidemiological conditions, viz. tropical heat for six months with little rain or wind, the presence of pools close to the camps, and an endemic of malaria in the native population. Unlike Flebbe, Bentmann maintains that quinine prophylaxis combined with other measures was of value in combating the disease.

**Pathology.** In a paper based on the study of 50 cases of pernicious malaria in Macedonia caused by *Plasmodium falciparum* Dudgeon and Clarke describe certain changes induced by the malarial parasite, e.g. fatty degeneration of the heart muscle and haemorrhages into the lung alveoli, and discuss the rôle of the suprarenals in death from pernicious malaria. Fatty degeneration of the heart muscle of a diffuse, moderate, or slight degree was present in 23 out of 45 fatal cases examined. The writers draw special attention to the clinical association of acute cardiac failure with fatty degeneration of the heart, and add that as degeneration of the myocardium is found in fatal cases there is every reason to suppose that cardio-muscular degeneration is present in cases which recover, as in diphtheria. It is therefore very desirable that the heart muscle should be saved undue exertion in this disease. Examination of the lungs in 33 cases showed that in pernicious malaria scattered areas of consolidation occur in which the anatomical basis is diapedesis of red cells into the alveoli, in extent usually of limited character, but in exceptional cases producing massive consolidation of lung tissue. The suprarenal glands were examined in 35 cases. The most constant lesion found was the reduction of the fatty lipoids of the cortical layers, which was present in 30 cases. In 5 cases only were other important histological changes observed, viz. thrombosis of capillaries with haemorrhages into the gland, degenerative changes in the cortex with or without blocking of the blood-vessels. The other viscera were similarly affected, and in no cases did the symptoms suggest a suprarenal insufficiency, as in the cases described by Paisseau and Lemaire.

**Symptomatology.** Cordier reports four cases of **pleurisy** and **peritonitis** occurring in malaria in which every other cause such as tubercle, cirrhosis, nephritis, and cachexia could be excluded. The complication in each case ran an acute course and ended in recovery.

In examination of 120 cases of malaria Carmalt Jones found **areas of hyperalgesia** similar to those which he had described in trench fever in 83 cases, or 70 per cent. The only differences were the more frequent escape of the lumbar area in malaria and the consequent reduction in the number of cases of complete distribution.

Genoese examined the **cerebrospinal fluid** during a malarial paroxysm in 10 children aged from 11 months to 6 years with the following results: (1) During the paroxysm, especially in severe cases, there was a more or less marked meningeal irritation as shown by chemical, physical, and cytological changes in the spinal fluid. (2) The albumin was almost always increased, but not so much as in acute meningitis. (3) The spinal fluid was almost always clear and under high tension. (4) The chlorides were increased (7·80–8·50 per thousand) owing to impairment of the renal function during the malarial paroxysm. (5) Cytological examination of the fluid showed in many cases a more or less intense lymphocytosis and rarely a polymorphonucleosis. (6) Sometimes there might be a cellular reaction in the spinal fluid without any corresponding clinical symptoms, or *vice versa*. There might be a complete meningeal syndrome without any increase in the cells of the spinal fluid but only high tension and excess of albumin.

Löwy examined the **vascular system** in 110 cases, 55 of which had malaria and 55 other diseases, and found that 43 per cent. of the former and only 22 per cent. of the latter presented some vascular change. 10 per cent. of the malarial cases and 5 per cent. of the others had blood-pressure of over 140 mm. Hg, and more than half of the malarial cases on X-ray examination showed a very broad aortic shadow although their average age was only 20–35 years. Broad aortic shadows in malaria had previously been described in Algiers by Dumolard, Aubry, and Granger, who drew attention to the extraordinary frequency of aortitis in this disease. Löwy admits that the malarial causation of the vascular changes in his cases could not always be definitely established, as other factors such as syphilis, nicotine, &c., could not be excluded.

The occurrence of **gangrene** in malaria, first described by Verneuil and Petit in 1883, is discussed by Alamartine, who reports three cases of gangrene of the limbs, two of which recovered after amputation and one died. It is not infrequent for a localized gangrene to occur in a malarial subject, its development being favoured by the patient's cachexia and condition of diminished resistance. Gangrene in the form of Raynaud's disease may be due to malaria (vide *Medical Science*, 1919, **1**, 60), but in such cases is caused by nervous disturbance rather than by vascular lesions. Extensive gangrene, such as Alamartine describes, due to endarteritis of the large arteries is less common, but several cases occurred in Macedonia in the summer of 1916, and were at first mistaken for 'trench foot'. Similar cases have been reported by Moreau, and Paisseau and Lemaire (vide *Medical Supplement*, 1918, **1**, 132 *a*); as regards the pathogenesis there is no doubt that the endarteritis and gangrene resulting are directly due to malaria. In all the cases observed the haematozoon was present in large quantities in the blood and viscera. An associated infection could easily be excluded. In Alamartine's cases the Wassermann reaction was negative, and the arteritis studied microscopically by Paisseau and Lemaire did not bear any resemblance to the typical lesions of syphilis.

In an article on **malaria from the surgeon's standpoint** White records acute haemorrhagic pancreatitis and appendicitis which cleared up under intramuscular injection of quinine without operation being necessary, and comes to the conclusion that the surgical manifestations, complications, and sequelae of malaria are due to failure to recognize the disease or to inadequate treatment with quinine. The writer emphasizes the fact that an operation may bring on an attack, often of a very severe nature. Prophylaxis against such attacks consists in giving 15 grains of quinine intramuscularly the night before operation. Acute dilatation of the heart during or following an operation in malarial subjects is very frequent, and the utmost precautions should be taken as regards anaesthetics. Ether by the Vernon-Harcourt method is safest, and chloroform is absolutely contra-indicated.

In an article on **unrecognized malaria** as a complication of other febrile diseases Ahlborn states that in Northern Livonia he found malarial parasites in persons who had been proved by bacteriological examination to be suffering from enteric fever, pneumococcal pneumonia, maxillary abscess, &c., although apart from an occasional enlargement of the spleen they showed no evidence of malaria. Slight deviations from the temperature curve usually met with in the diseases mentioned suggested an examination for malarial plasmodia, which were found in as much as 40 per cent. of the cases. As a result of this experience Ahlborn examined the blood in all febrile diseases, and found that a large proportion of cases of acute nephritis showed malarial parasites. The fever in these cases was more or less high, with irregular oscillations quite unlike malaria. After quinine treatment not only did the parasites disappear but the excretion of albumin and haemoglobin rapidly subsided. More than 50 of over 100 cases admitted to hospital as influenza were found to be carriers of malarial plasmodia. The temperature chart in most of these cases differed from that seen in uncomplicated cases of influenza by the absence of a critical fall of temperature. Whereas the ordinary influenzal fever lasted as a rule only two to four days, in the malarial cases a febrile period of eight to ten days was not exceptional. In conclusion, Ahlborn suggests that all soldiers on their return from active service should have their blood examined for malaria as well as for syphilis, especially those who come from malarial districts, and those who are suffering from a febrile disease of a doubtful nature.

The **association of malaria and enteric fever** is discussed by Job and Hirtzmann (1), who record 3 cases, in 2 of which malaria was concurrent with paratyphoid A, and in 1 with typhoid. In another 2 cases of malaria paratyphoid B bacilli were found in the blood, but did not possess any pathogenic significance. As a general rule the enteric infection occurs at the same time as the first attack of malaria, but it may coincide with the occurrence of a relapse. The exact diagnosis can only be made by examination of the blood. The prognosis of enteric is aggravated by malaria, even if the latter disease is not active. The prognosis of an attack of malaria occurring during the decline of enteric is favourable, if its true nature is recognized.

Job and Hirtzmann (2) elsewhere point out that chronic malaria may be accompanied by diarrhoea of a variable character which may be mistaken for an attack of dysentery. As a rule the diagnosis can only be made by bacteriological examination and the result of quinine treatment. The pathogenesis of the condition varies; in some cases the haematozoon acts directly on the intestinal mucous membrane, and in others through the medium of the liver, or perhaps of the pancreas or abdominal nervous system. Lastly, in some instances, malaria merely aggravates a pre-existing colitis which is frequent in warm climates.

In a subsequent communication Job and Hirtzmann (3) state that the association of bacillary dysentery and malaria is a frequent occurrence. As a rule a favourable issue may be expected, even if the two diseases are concurrent, provided they are properly treated: but in exceptional cases the prognosis is not so good, and, as in two cases reported by the writers, a grave attack of malaria may prove a fatal complication of dysentery.

All forms of malaria undoubtedly predispose to bacillary dysentery, and attacks of malarial fever are particularly frequent in convalescents from bacillary dysentery. Owing to the injurious effect of malaria upon the intestines, convalescence from dysentery is apt to be prolonged in malarial subjects, and is characterized by the persistence of diarrhoea, which sometimes lasts a very long time and assumes the form of entero-colitis.

Ward draws attention to the following close **resemblances between malaria and trench fever**: (1) In both the onset usually seems abrupt, but indefinite prodromal symptoms are almost certain in each case. (2) The temperature chart of malaria very often shows a tendency to groups of rises of temperature like trench fever. (3) Comparison of the pains of malaria and trench fever shows that certain of them, especially those felt in the back and legs, are dependent on cutaneous hyperalgesia. (4) The effect of exercise in both diseases, such as allowing the patient to get out of bed, is usually to precipitate a recurrence of the pains and a rise of temperature and pulse-rate. (5) In both diseases the headache is usually frontal, less often temporal, and rarely occipital. In both diseases there is a great tendency to involvement of the part of the supraorbital nerve within the orbit, giving rise to pain behind the eyes and in moving the eyes. (6) Vasomotor symptoms resembling Raynaud's disease or erythromelalgia and local oedema of the shins have been found in both diseases. (7) Both diseases are characterized by a long duration and attended with serious debility.

**Diagnosis.** Sassen follows Morawitz in distinguishing four groups of provocative methods: (1) Use of foreign albumin, e.g. typhoid vaccine, sterile milk, tuberculin, normal horse serum, and diphtheria antitoxin. According to the results obtained hitherto injection of normal horse serum appears to be the best method, as in many cases it helps to confirm the diagnosis, where the injection of other serums fails. (2) Injection of substances which act on the circulation, such as ergot, adrenalin, or pituitary extract, as recommended by Neuschloss, Schittenhelm and Schlecht, and others (vide *Medical Science*, 1919, **1**, 62). Adrenalin appears to be the best agent in this group, as it is the cheapest, most readily obtained, and most rapidly-acting drug. (3) Quinine. In Italy Cori's method of using small doses of quinine for provocative purposes has been in use for many years, and has recently been employed by Mandoki and Maule (vide *Medical Supplement*, 1918, **1**, 134 *a*), but the method is not reliable. (4) Physical methods, such as the quartz-lamp, X-rays, cold douching or faradization of the splenic region as employed by Hoffmann (vide *Medical Science*, 1919, **1**, 63). At present the number of observations with all these methods is too small to justify a definite conclusion as to their value.

Arnsperger regards injections of milk as the most reliable provocative method (two intramuscular injections of 5–10 c.c. of milk sterilized for 10 minutes with an interval of a week between each injection). The date of appearance of a malaria attack after the injections varies considerably, being sometimes delayed for 14 days. Arnsperger's method of provocation is as follows: Directly after the end of the quinine course the first injection of milk is given, and the next week he orders faradization and douching of the spleen and a faradic bath. On the eighth day the second injection of milk is given, and this is followed by a long march, and finally at the end of the second week adrenalin or pituitary extract is injected. In 36 per cent. of the cases so treated the existence or persistence of malaria was discovered. This number is much the same as that of spontaneous relapses. As regards the results of provocative methods on the different forms of plasmodia, 47 per cent. of the tertian and 32 per cent. of the tropical cases gave a positive result. The frequency of spontaneous relapses according to Tsuzuki and Celli is 36·86 and 49 per cent. respectively for benign, and 12·23 and 23 per cent. respectively for malignant tertian. The number of cases which remained negative after provocative treatment but subsequently had relapses, was very small—about 5 per thousand. This is, however, sufficient to show that even the most energetic provocative methods are not invariably successful.

Benzol, as a provocative agent of inactive malaria, is recommended by Henszelman, who reports six cases of chronic malaria in which, after administration of 0·10 grm. of benzol in capsules three times a day and later of 0·5 grm., typical febrile attacks occurred on the first, third, and eighth day, and continued as long as the drug was given. After it had been stopped the attacks ceased, and returned when it was resumed. When benzol was combined with quinine or neo-salvarsan complete recovery took place. At the time of writing the cases had not had any relapses for months, and the anaemia had disappeared. One of these patients who had formerly been treated unsuccessfully with quinine and salvarsan had a slight remittent fever almost daily, and was confined to bed suffering from cachexia and debility. Henszelman thinks it probable that the gametes which were usually hidden in the blood-forming organs sporulate under the stimulus of the benzol and produce schizonts upon which quinine and salvarsan exercise their specific action.

Böhme recommends that provocative methods should not be employed until after the end of a quinine course, i.e. after about three months' treatment, in order to determine if the infection is eliminated. Of 212 cases tested by provocative methods after five weeks' treatment in hospital only five showed parasites in the blood, and in another 14 cases which should be regarded as carriers of infection the temperature rose to 100·4, though no parasites were found in the blood. The number of carriers is probably larger still, as cases with only a few parasites in the internal organs do not react to provocative methods, so that Böhme estimates that at least 9 per cent. of his cases were still carriers after five weeks' treatment.

Böhme did not find that cases in which attacks had been produced by provocative methods during quinine treatment ran a more favourable course than those in which these methods were not employed. When an attack is so produced, an increase in the number of the malarial parasites takes place, and even though a large number of them are undoubtedly destroyed by quinine, a certain proportion are deposited in the internal organs, so that the condition is the same as before the provocation.

Unlike Sassen and others, who regard provocative methods as indispensable in the treatment of malaria, Bruns deprecates such a procedure on the ground that patients who are subjected to this treatment are often kept idle for weeks at a time in hospital before a malarial paroxysm can be successfully produced. He also lays special stress on the importance of keeping the malarial patient while under treatment at rest, and avoiding any stimulation of the circulatory or nervous system.

**Prophylaxis.** From his experience in Mesopotamia, which is not a very malarious country, and where death from uncomplicated malaria is rare, Gosse comes to the conclusion that prophylactic administration of quinine is of the greatest benefit. On the other hand, in badly malarious countries such as Northern Persia or Salonica the method is almost or quite useless owing to the fact that after frequent bites in the 24 hours from infectious mosquitoes 5 or 10 grains of quinine, or even larger doses, are insufficient to kill the parasite except in a very few cases.

**Treatment.** Patrick gives the following record of his experiences with intravenous injections of a 5 per cent. solution of quinine bihydrochloride and a 1 per cent. solution of antimony tartrate from February 1917 to July 1918 in patients from the Salonica army who had been transferred to a Malta hospital: (1) of 104 patients with chronic relapsing tertian malaria who were treated in 1917 with intravenous injections—three of quinine bihydrochloride and five of antimony tartrate—55 per cent. remained free from attack for three months or longer. (2) A few cases treated similarly in the spring of 1918 gave much less favourable results. (3) Intravenous injections of quinine will check any series of attacks, but will not have much effect in preventing relapses. (4) Intravenous injections of antimony tartrate gradually exercise a destructive influence on the parasite, and have an effect in preventing relapses. (5) In cases of subtertian malaria the best treatment is by intravenous injection of quinine. (6) Intravenous injections of antimony tartrate have some effect in causing crescents to disappear from the blood.

Stephens, Yorke, Blacklock, and Macfie (1) investigated the action of arsenic and quinine in quartan malaria. In two cases two intramuscular injections of novarsenobillon, 0·9 grm., were given at an interval of approximately a week without any effect on the temperature or the parasites. An intramuscular injection of quinine bihydrochloride, gr. xv, was then given on each of two consecutive days in each of the cases. In neither case did the injection cause disappearance of the parasites. In one case the temperature was controlled, and in the other it was not. On the other hand, the action of novarsenobillon on *Plasmodium vivax* was marked, a single intravenous injection of 0·9 grm. causing disappearance from the cutaneous blood of all signs of the parasites in 24 hours. An intramuscular injection of quinine bihydrochloride on each of two consecutive days in the case of *Plasmodium vivax* also had a rapid effect on the temperature and parasites; in the case of *Plasmodium falciparum* the action on the temperature and trophozoites was well defined, though relapses occurred more quickly than in the case of *Plasmodium vivax.* Stephens and his collaborators (2) found that a combination of novarsenobillon and quinine was more effective than either novarsenobillon or quinine alone.

The inefficiency of arsenic in quartan malaria is also illustrated by Neumann, who records a case in which neosalvarsan had no action on the fever.

As the result of seventeen months' experience of Macedonian malaria Wiltshire is convinced that intramuscular injection of quinine is vastly more efficacious than oral administration in the following respects: (1) It improves the prognosis of life. (2) It is more certain in action during the acute stages of the disease. (3) It adds greatly to the chance of effecting a real cure. Patients so treated are given injections of 20 grains twice daily for four days. On the fifth day treatment is continued by mouth, most patients receiving 30 grains a day for a further period of three weeks at least. A 50 per cent. solution of quinine bihydrochloride is used for injection. This is sterilized in an autoclave three days in succession before issue, and again every morning when in use.

Of 214 cases of benign tertian malaria treated by Böhme with neosalvarsan and quinine 13, or 6·1 per cent., had a relapse during their stay in hospital or shortly after their discharge. This figure is not half as large as the number of relapses which occurred among the total (13·5 per cent.). The immediate action of neosalvarsan on the disease was best seen in those cases in which the drug was given during a febrile attack. The temperature almost always fell after the injection, and the parasites disappeared from the blood in 24 hours at the latest.

After three years' experience in the Mississippi Delta Bass has adopted the following treatment, which he states will disinfect more than 90 per cent. of cases. The treatment for adults is gr. x of quinine sulphate every night before retiring, for a period of 8 weeks. In acute attacks gr. x should be given three times a day for a period of 3–4 days, and be followed by the 8 weeks' treatment to eliminate the infection. For children the dose that gives the same results as gr. x in adults is: under 1 year, gr. ½; 1 year, gr. j; 2 years, gr. ij; 3 and 4 years, gr. iij; 5–7 years, gr. iv; 8–10 years, gr. vj; 11–14 years, gr. viij; 15 years and over, gr. x.

As the result of observations carried out at the Hôpital Pasteur in 1917, Marchoux has found that all the alkaloids of cinchona, including quinidine, cinchonine, hydroquinine, and hydrocinchonine in doses of 1 grm. have the same curative action on malaria as quinine. These results allow considerable saving to be effected, as instead of 5 per cent. it is now possible to extract 10–15 per cent. of active matter from cinchona.

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## RENAL DISORDERS

**War nephritis.** According to Kollert acute nephritis was only rarely found in soldiers during the first year of the war, but the incidence of the disease increased as the war continued. The percentage of cases at the front was considerably greater than on the lines of communication owing to the more strenuous work and the occasional absence of opportunities for rest in the former situation. The variety of the disease in officers was due to the same factors and also to better protection from infection. Soldiers belonging to infantry regiments were chiefly attacked, as they were subjected to the severest physical exertions. Kollert frequently had the opportunity of confirming Chiari's observation that a relatively large number of soldiers with cardiac disease contracted renal affections.

In a paper on war nephritis based on the study of 254 cases Toenniessen gives the following statistics relating to the frequency of the principal symptoms:

| | |
|---|---|
| Albuminuria, slight (under 1 per 1,000) | 43 per cent. |
| " moderate (1–5 per 1,000) | 35 " |
| " well-marked (over 5 per 1000) | 22 " |
| Haematuria, slight | 64 " |
| " marked | 36 " |
| Well-marked albuminuria and haematuria | 9 " |
| Blood-pressure not raised | 50 " |
| " between 140 and 180 | 29 " |
| " over 180 | 21 " |

| | |
|---|---|
| Residual nitrogen slightly increased (40–60 mg.) | 40 per cent. |
| „ distinctly „ (60–100 mg.) | 14 „ |
| „ considerably „ (over 100 mg.) | 3 „ |
| Uraemia . . . . . . . . . | 11 „ |
| Retinitis . . . . . . . . . | 8 „ |
| Cardiac enlargement . . . . . . | 30 „ |
| Oedema . . . . . . . . . | 80 „ |

There was nothing in the history of Toenniessen's cases to show that a former disease of the kind or family tendency to renal disease played any essential part in the causation of war nephritis. A few patients stated that they had contracted the disease after severe physical efforts such as marching or making trenches. 12 per cent. gave a history of chill without getting wet through, and 23 per cent. of getting wet through and subsequent chill. In 50 per cent. no cause could be incriminated. The disorders which immediately preceded the nephritis were as follows: Gastro-intestinal disease two cases only, sore throat and fever in 8 per cent., cough and expectoration in 5 per cent., shivering in 6 per cent. Fever was observed in a few cases 3–14 days before the outbreak of nephritis, headache, backache, and pains in the limbs occurred in 5 per cent., ardor urinae in 3 per cent., and jaundice in one case. Toenniessen classifies his cases in four groups according as they ended in (1) complete recovery, (2) incomplete recovery, (3) chronic nephritis, (4) death.

(1) 68 per cent. of the cases ended in complete recovery in a period varying from six weeks to ten months, the average time being four to six months. The cases which recovered usually had no rise of blood-pressure, even in the first fortnight of the disease. In 34 per cent. there was a rise of blood-pressure (150–200), which fell to normal in from one to four months at the latest. Oedema was present in most of these cases, and was sometimes of a very considerable degree, but disappeared in from two to eight weeks. Well-marked retinitis was present in only one case. As regards renal function, excretion of water was usually good. The power of concentrating the urine was impaired in 14 per cent. and only in a slight degree.

(2) The cases in which recovery was incomplete consisted of those in which the effects of nephritis disappeared in a few months, but the pathological changes in the urine persisted. 12 per cent. of the cases belonged to this group. The rise of blood-pressure was not more frequent and did not last longer than in Group 1. On the other hand, a moderate increase of residual nitrogen was more frequent for months after the oedema had disappeared. The excretion of water was usually delayed, and the power of concentrating the urine was impaired in 40 per cent.

(3) Chronic nephritis was observed in 13 per cent., the cases varying according as the blood-pressure (*a*) was high at first and then gradually fell, (*b*) rose to a moderate height at the onset and kept at the same level, (*c*) was normal at first and then rose to a high level, (*d*) gradually rose with a simultaneous increase in the pathological elements in the urine, (*e*) remained normal throughout although the general course of the disease was chronic and progressive.

(4) Fatal cases constituted 3 per cent. of the total, the duration of the disease being three to four months. There was no history of renal disease in any of the cases. Uraemic attacks occurred in the second half of the disease and extreme retinitis was common in all cases. Death was due to cardiac insufficiency or uraemia.

As regards the prognosis Toenniessen states that there is hardly any symptom on the presence or absence of which one can form a prognosis. More important than the intensity of the individual symptoms is their duration or the time of their appearance after the onset. The future course of the disease can be determined at the latest after four to six weeks. In favourable cases the oedema has usually disappeared by then, the blood-pressure has become normal or is gradually subsiding, and the urine contains only traces of albumin, casts, or blood. Functional tests at this time are hardly of any value. It is only after three or four months that the symptoms acquire a more serious prognostic significance. This especially applies to the blood-pressure, residual nitrogen, and uraemic manifestations. The amount of albumin, blood or casts in the urine is of less prognostic significance, as the pathological elements in the urine do not always increase with an aggravation of the general condition. A frequent recurrence of haematuria, however, without obvious cause is an unfavourable sign. Functional tests after three or four months increase considerably in significance, although even favourable results are not a guarantee of recovery. On the other hand, a bad result of the water and concentration tests at this time is only found in chronic cases and is of unfavourable prognosis. In protracted cases a final prognosis can be made at the end of about six months. If the blood-pressure or residual nitrogen is still decidedly raised, a chronic progressive disease is present. The presence of pathological elements in the urine is of little help in deciding whether there is a defective recovery or chronic nephritis, but an amount of albumin exceeding 1 per 1,000 suggests a transition to chronic nephritis.

McCordick and Robbins analysed the records of 2,490 returned soldiers and found that in only 17 instances was there no mention of any urinary examination. There were 87 cases of nephritis, in only three of which nephritis was a definite complication of other conditions (tuberculosis and syphilis). There were therefore 84 cases of primary nephritis, which were subdivided into three groups: (1) Those in which a pre-existing nephritis was suspected from the history (seven cases). (2) Patients who had seen service only in England and had never gone to France (nine cases). (3) Returned soldiers who had seen active service in France (68 cases). Analysis of the histories of these 68 cases showed that in some instances infections preceded the disease, in others wounds, and in others again exposure was the apparent cause, but no one influence was predominant. The writers conclude that ‘war nephritis’ is mild in type, runs an inoffensive course, produces no serious cardio-vascular changes, does not destroy kidney substance to any extent, and 50 per cent. at least progress favourably to a cure.

In a paper based on the study of 100 cases of war nephritis, Gerhardt states that the total duration of the disease as reckoned from the onset until discharge from hospital ranged from two to thirteen months, the usual time being four to eight months. On discharge many of the patients still complained of pain in the region of the kidneys, and often of general debility and lassitude. In 58 there were no objective signs to be found; 42 still showed some residue of the disease either in the urine, the functioning of the kidneys, or the circulatory system. The symptoms, however, were so slight that with certain exceptions they could be discharged for duty in garrison or labour battalions. 23, or nearly a quarter of the total, showed a residual albuminuria as the only symptom, but in most of the cases merely a trace of albumin was present. In all the cases the albuminuria was constant, and was not affected by the character of the diet, the occupation, or a vertical or recumbent posture. Residual albuminuria was only regarded as harmless when ordinary diet and physical exercise caused no increase in its amount. Permission to go home was allowed as a resistance test; in three cases the previous slight amount of albumin was increased, but always returned within a few days to its former amount. Ten cases in all were discharged with symptoms of chronic nephritis, but in only three of these had the kidneys been healthy before the attack of war nephritis (Goldscheider estimates that the transition to chronic nephritis occurs in 10 per cent.). A distinct rise of blood-pressure was observed in 44 cases. It usually subsided in three to four weeks, and only in three cases did it last three to six months. The blood-pressure remained persistently high only in cases which ended in chronic nephritis. The renal function as examined by Strauss's test usually became normal a considerable time before the disappearance of albuminuria.

Moog and Schürer record their observations on the blood-pressure in war nephritis. The systolic and diastolic pressures were taken with Riva-Rocci's instrument by the auscultatory method, and in most cases also by palpation, every morning between 9 and 10 a.m. and every evening between 5 and 6 p.m. for weeks at a time. The rise of blood-pressure was subject to great variations. Sometimes it was only present on the first day, and then merely after arrival of the patient. In mild cases the reading immediately after arrival was 150 mm. Hg, but on the following days never exceeded 140 mm. In a typical case of rise of blood-pressure, such as occurred in the majority of severe attacks, the initial rise was followed in the course of the first week by a drop, and then by another gradual rise. At this stage well-marked remissions were liable to occur, and the rise of blood-pressure might easily escape notice if the measurement was made only once in the day. When the blood-pressure reached a certain height it remained at that level for a few days, in severe cases for a week or longer, and then slowly fell again. During the stage in which it was falling there was a considerable difference in a number of cases between the morning and evening measurements, the evening record being usually the highest. The rise of blood-pressure was accompanied by a gradual increase in the amount of urine, usually towards the end of the first week. In exceptional cases and only in mild attacks there was a very rapid fall from as high a level as 200 mm. Hg to normal. A complete absence of any rise of pressure in spite of regular measurements daily was observed in a few cases, especially in those with a high degree of dropsy. In some cases of this kind secondary heart failure may be the cause of the absence of the rise of blood-pressure. In the dropsical form of war nephritis the diastolic pressure was subject to much less variation than the systolic, but remained longer at a higher level. The chart of the blood-pressure showed a striking resemblance to the temperature chart of a fever case in its stage of invasion, fastigium, and stage of decline. The resemblance was not a mere coincidence but was the expression of an infective process. The rise of blood-pressure in acute glomerular nephritis, like fever in other infectious diseases, is essentially a functional disturbance, and is not directly caused by anatomical changes.

The causes of the rise of blood-pressure like that of the fever should be sought for in a disturbance of the central nervous regulating mechanism. The old theory, first proposed by Johnson, that the cause of the rise of blood-pressure is a functional contraction of the small arteries of the general circulation finds a support in the great daily variations of the blood-pressure. It is difficult to imagine how a rise of blood-pressure, which in the course of a few hours may be about 40–50 mm. Hg, e. g. from a normal or almost normal level to 180 mm., can be due to inflammatory processes in the capillaries.

In 1916 Schütz pointed out that though the prognosis of war nephritis was favourable as regards life, provided the disease was recognized in time and the patient properly treated, the prognosis as regards complete recovery should be very reserved. A too optimistic prognosis was due to the fact that in most cases the only criterion of recovery was the disappearance of blood and albumin from the urine. In a number of cases, however, although the urine is normal, the blood-pressure is raised and changes in the fundus are much more frequent than is generally supposed. Even in cases in which the urine, blood-pressure, and fundus are normal, tests of the renal functions may show diminution of the power of eliminating water and concentrating urine. Owing to these considerations Schütz and Reitler have recently applied functional tests to a hundred nephritis cases who might be regarded as cured, and in only 5 per cent. was a completely normal result obtained. In 45 cases of cured nephritis lordosis experiments were carried out, and in only one instance was lordotic and orthotic albuminuria found. The writers also carried out functional tests on persons with apparently healthy kidneys, and to their surprise found that the percentage of functional disturbance among them was only slightly less than in those who had had undoubted nephritis and showed no pathological symptoms at the time of examination. The question therefore arose as to whether the diagnostic and prognostic value of the functional tests was affected by these observations. Two possibilities had to be considered. The first was that as the result of the war many more people had disorders of the renal functions than was formerly the case, and that these disorders were merely shown by the abnormal results of the functional tests. The other possibility was that the abnormal result of the test was not due to a lesion of the kidneys themselves, but to a disturbance of the regulation of water in the system generally, like war polyuria or the oedema disease, which are mainly due to extrarenal disturbances. The writers conclude that in some of the cases with 'impaired renal function' renal causes are responsible, and in others extrarenal causes, or a combination of both. The prognosis must never be made on the basis of the functional tests alone, but the result of these tests must merely be regarded as one of the criteria in the estimation of the case.

Merklen and Desclaux examined 26 men who had been temporarily discharged from the army for chronic nephritis a year previously with the following results: (1) Six men had no albuminuria nor any signs of renal or cardiac disturbance. There was no rise of blood-pressure, and the heart was of normal size on radioscopic examination. They might therefore be regarded provisionally as cured. (2) Three showed cardio-vascular symptoms only, such as an increase in the size of the left ventricle, accentuation of the second aortic sound, palpitation, and a high blood-pressure. (3) 17 cases, or two-thirds of the total, showed various symptoms of chronic nephritis, and albuminuria was present in all.

Though it is impossible to make a general prognosis in nephritis owing to the variable character of the affection, the writers feel justified in concluding that at the end of a year the majority of men who have been discharged from the army for nephritis will still present symptoms of the condition.

Denoncin and Gillet discuss the clinical significance of casts, especially epithelial ones, and their importance in the detection of simulated albuminuria, in a paper based on a large number of chemical and microscopical examinations of specimens of urine in Belgian soldiers. Their conclusions are as follows: (1) In diseases with renal complications, or in patients with symptoms of Bright's disease, the presence of casts, especially epithelial casts, is a more constant sign than albuminuria, and their persistence, even in the absence of albumin, is very important pathologically. The casts appear to be the result either of nephritis properly so called or of abnormal metabolism in which toxic products are eliminated by the kidneys. (2) The amount of casts, especially epithelial casts, is an index of the toxicity of the diet and of the sensitiveness of the kidney to endogenous or exogenous toxins. (3) Before adopting any energetic form of treatment such as vaccines or injection of salvarsan, it should be ascertained whether the kidneys are normal, not only by the absence of albumin, but also by the absence of casts, especially epithelial casts. (4) In febrile disorders the absence of albuminuria should not be regarded as the only sign of the resistance of the kidneys. An absence of casts, especially epithelial ones, is also essential. (5) In a nephritis which is clearing up, the albumin disappears from the urine almost always before the casts, which may persist for some time. (6) Small quantities of albumin may exceptionally occur in the urine without epithelial or granular casts. The absence of casts, however, is rare, and never occurs when the quantity of albumin is considerable.

According to Péhu, Daguet, and Martin, comparatively few autopsies have been made on cases of war nephritis, as death from this cause is rare, and the only cases which have hitherto come to autopsy have been those in which the disease has lasted a few days or weeks at most. The writers record the autopsy on a case in which the condition had lasted for two years, death being preceded by symptoms of cardiac failure. Examination showed a subacute diffuse bilateral nephritis, without any striking histological features, thus confirming the opinion generally held that war nephritis, from the anatomical and clinical standpoint at least, does not possess any pathognomonic characteristic.

**Nephritis without albuminuria.** Davidsohn states that his personal experience and a study of the literature have convinced him that acute nephritis without albuminuria is by no means uncommon, especially at the present time, when there is an opportunity of observing so large a number of cases of war nephritis. He records two personal cases which began with haematuria lasting three to four days, one of the cases being accompanied by colicky pains. It is possible, however, that nephritis of this kind may occur without the alarming initial haematuria. The cases hitherto observed are usually attended with a diminution in the amount of urine excreted. They probably correspond pathologically to a circumscribed glomerulonephritis, as every case of acute nephritis may take on a chronic course in the absence of proper treatment. These cases show the necessity of repeated chemical and microscopical examination of the urine in all diseases suggestive of nephritis, as examination of the sediment may reveal various forms of casts and red and white cells in spite of the absence of albumin.

Commenting on Davidsohn's paper, Tröscher remarks that during treatment with mercury and salvarsan he has frequently noted slight damage to the kidneys which was revealed only by excretion of casts, leucocytes, and exceptionally red corpuscles without albumin. As was shown by one case which died with signs of salvarsan poisoning and presented severe chronic interstitial nephritis at the autopsy, a mere chemical examination of the urine is not sufficient to exclude renal disease. Since that case occurred Tröscher has examined microscopically the urine of every syphilitic case during treatment by mercury and salvarsan once or twice a week, and in a large number of instances found leucocytes and casts although the urine was free from albumin. In such cases the treatment was stopped and in six to eight days the urine was normal again without dietetic or other treatment. The absence of albumin showed that the nephritis was not syphilitic. The renal change was always attributed to mercury, as it occurred in patients who had not had any salvarsan. It does not by any means contra-indicate mercury and salvarsan treatment, as the excretion of casts and leucocytes lasted only a short time and never prevented a regular course of twelve to fifteen injections of mercury salicylate and six to eight intravenous injections of salvarsan. Zieler agrees with Tröscher as to the necessity of examining the urinary sediment microscopically at least in the second half of a course of mercurial treatment. Investigations carried out by Mandelbaum under Zieler's supervision showed that the passage of hyaline casts always ceased spontaneously in the course of two to three months after the end of the treatment. The occurrence of casts is most marked after the use of calomel and may necessitate the use of a milder preparation or the interruption of the treatment for a time.

**Ocular palsies in nephritis** are exceptional, and hitherto have only been described from the clinical standpoint. Bernheimer could find only three cases in the literature, to which he added one of his own, the sixth nerve being affected in two cases. Another two cases have been observed by Groenouw. Velhagen records a fatal case of chronic nephritis in a woman aged 36, who in addition to severe albuminuric retinitis presented complete paralysis of the left sixth nerve. At the autopsy a small haemorrhage was found in the pons due to the rupture of an aneurysm of a branch of the basilar artery. The rest of the brain was intact.

Different opinions are held as to the frequency of **exophthalmos in chronic nephritis**. A certain number of American writers, such as Barker and Hanes, Gordinier and Bishop, have found it very common (48·4 per cent.), while Fyson, on the other hand, has never seen a case. In the course of five months Rondopoulo of Athens observed only two examples among 52 cases of subacute or chronic nephritis in men aged 52 and 67 respectively. As the sign may be readily overlooked, a minute examination by an eye specialist is required.

**Blood-sugar in nephritis.** Williams and Humphreys made observations on the blood-sugar in 50 cases of nephritis, which they divided into three groups according to the blood-sugar content. In the early stages of interstitial or parenchymatous nephritis, when the general metabolism of the body is but little disturbed, blood-sugars as a rule are normal. In the last stage, when the patient is uraemic, the blood-sugar is very high, often equalling the blood-sugar levels of severe diabetes. In a third group of cardio-renal cases characterized by high blood-pressure and little or no evidence of renal disturbance the blood-sugar level is usually higher than normal. As a general rule high blood-sugar levels are associated with the severe phases of cardio-renal disease. These patients often excrete small quantities of sugar in the urine, although there appears to be no such quantitative relationship between the food intake and the sugar output in the urine as obtains in diabetes. In such cases the blood-sugar level is inappreciably influenced by carbohydrate restriction, and the patients should therefore not be subjected to the discomfort of rigorous antidiabetic diet.

At a meeting of the Frankfort Medical Club on March 3 Bloch read a paper on **rheumatic diseases of the urinary organs**, the term 'rheumatic' indicating the action of toxins on an organism predisposed by cold. His observations were based on a study of numerous cases of the kind in a military hospital at Strasburg in 1916, and more recently in private practice both among men and women. The following three types of the disease were distinguished, though transitional forms might also occur: (1) Pollakiuria without polyuria, the urine being clear and free from albumin. The sediment always contained a few red corpuscles and leucocytes and an unusually large number of cylindroids. (2) In this type the symptoms were more referable to the ureters and kidneys; women and girls were frequently affected, their complaint being pain in one or both sides of the abdomen. The urine was clear, but the sediment contained red corpuscles, leucocytes, and numerous mucous casts. (3) In this type there was severe ardor urinae, frequent micturition, and often pain in one or both kidneys. The urine was turbid, reddish in colour, and contained numerous red corpuscles, more than 10 per 1,000, albumin, and often hyaline casts. In all these cases bacteriological examination was negative. Bloch attributes the condition to a latent irritation of the urinary passages which is roused into activity by a chill or some other deleterious influence. The irritation is produced by toxic substances in the urine which have been produced by the absence of certain accessory food constituents in the war diet. The disease affects the mucous membranes of the urinary passages, but may also cause a secondary interstitial inflammation of the kidneys at an early stage, before any symptoms are present, and in severe cases of rheumatic pyelonephritis may lead to chronic nephritis.

Foerster describes three cases in soldiers of **haemoglobinuria following marching** which differed from the ordinary form of paroxysmal haemoglobinuria by the attacks occurring in perfectly healthy men, and being preceded not by a chill, but, as its name (Marschhämoglobinurie) implies, by more or less strenuous marching, an absence of any marked constitutional disturbance, and a resistance to any active treatment. In none of the cases was there any evidence of syphilis, and there were no symptoms during the attack, apart from more or less severe pains in certain groups of muscles. In the intervals the urine was perfectly normal, but during the attacks was brownish red, the discoloration being shown by chemical and spectroscopic examination to be due to blood pigment. The sediment was brownish in colour and amorphous, casts and red cells or their stroma not being present. The attacks occurred only after marching or cycling, and not at rest, nor after a chill. A lordotic attitude did not tend to bring on an attack, nor did a kyphotic attitude prevent it occurring. The fact that in two cases the attacks were preceded by well-marked pain in the muscles is in favour of Meyer-Betz's view that disturbances occur in the muscles after marching which give rise to a 'haemoglobinuria muscularis' in contrast with the 'haemoglobinuria globularis' after paroxysmal haemoglobinuria.

**Idiopathic enuresis in adults** is discussed by Caro, who records a series of 25 cases in soldiers aged between 17 and 38. 13 gave a family history of a similar condition or other neuropathic traits or of cardio-renal disease. A history of nocturnal enuresis dating from childhood with periods of remission was obtained in 21. Physical examination showed vagotonic trends, such as cold skin, cyanotic hands, marked localized perspiration, deep-set eyes, acneiform eruptions, increased flow of saliva, and diminution of the faucial reflexes. Facial asymmetry was noted in 13, and deviations from the normal in regard to the hard palate were usually present. Urological examination was negative, and no lesions of the spinal cord were found. All the patients showed border-line defects in mental efficiency.

Meyer records two cases of **spontaneous perirenal haemorrhage** in men aged 27 and 42 respectively. In one case the condition was at first mistaken for lumbago, and subsequently for appendicitis. Recovery followed an operation, at which a perforation of the right kidney was found, and 30 oz. of clotted blood were evacuated. Examination of the right kidney, which was removed, showed an ascending infection with multiple abscesses and erosion of an arcuate artery. In the other case, in which a diagnosis of hypernephroma of the left kidney was made, the lesion, which developed after pneumonia and endocarditis, was probably a haemorrhagic infarct. Death occurred on the day after the operation, and a post-mortem examination could not be obtained.

**Treatment.** Porges and Preminger treated 83 cases of nephritis in soldiers with calcium lactate. During the first two weeks each patient was given 3 grm. of the drug daily. This was followed by a fortnight's rest, and then by a second course of calcium lactate for another fortnight. In each case the course of treatment was repeated from four to six times, the daily dose being up to 9 grm., and in some cases to 12 grm., without any bad effects. The drug was given in watery solution three or four times a day in equal doses. The results of the treatment were as follows: (1) In the great majority of cases the improvement was much more pronounced after the course of calcium lactate than after the rest period, especially as regards the pathological constituents of the urine (blood and albumin). (2) The greatest improvement was obtained with a dose of about 6 grm. (3) The renal function also showed improvement. In some cases it was unaffected, but in no case did any deterioration of function occur, as was observed by Eisner and Jacoby after calcium treatment. A second series of investigations was made on 57 patients in whom calcium lactate was combined with the Marienbad Rudolf spring-water containing calcium, 6 grm. of calcium lactate being given with 700 grm. of Marienbad water daily. A fortnight's course was followed by a rest of equal length, and was repeated 3 to 6 times. The results obtained by the combined method were better than those obtained by the calcium treatment alone, diminution of albumin being found in 51·8 per cent. of the patients treated by calcium lactate alone, and in 66·7 per cent. of those treated by the combined method. The diminution in the number of the red cells and casts was also in favour of the combined method, and there was a simultaneous improvement in renal function. The superiority of the combined method was found to be due to the presence of magnesium as well as calcium in the Marienbad water.

Magnesium alone, however, was not the active principle, as was proved by the fact that the administration of even small doses (2 grm. in the form of magnesia) caused a distinct aggravation of the condition shown by an increase of the red cells and casts in the urine. On the other hand, the combination of magnesium and calcium, so far from acting injuriously, produced an improvement which was greater than that obtained by calcium alone. Of the various forms of kidney disease subacute glomerular nephritis appeared to respond best to calcium treatment. The method was not used in the case of oedematous patients or of those with much renal insufficiency.

In 1917 Gross reported cases in which he had obtained considerable improvement or actual cure in cases of chronic pyelitis and cysto-pyelitis, chiefly of gonorrhoeal origin, by intravenous injection of neosalvarsan, the beneficial action of which was attributed to the fact that neosalvarsan is a condensation product of salvarsan and acid sodium formaldehydesulphoxylate, and gives off formaldehyde in the circulation under specially favourable circumstances, probably in the kidney. Gross was able to show by chemical tests that 20–30 minutes after injection of neosalvarsan formaldehyde could be found in the urine. Encouraged by these results Nathan and Reinecke treated 11 cases of **acute** pyelitis of gonorrhoeal origin in women by injections of neosalvarsan in doses of 0·15 grm. every second or third day. The urine became rapidly clear, the temperature fell, the renal tenderness and the general condition improved. No bad effects attributable to neosalvarsan were observed.

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J. D. R.

## DIABETES

In an article on **war diet and diabetes** Elias and Singer state that the favourable effect on diabetes mellitus of deficient nourishment during wartime was first described by Bouchardat from observations made during the siege of Paris. Several similar observations have been made during the recent war. Albu has seen at least a dozen cases of mild alimentary diabetes, mostly in old persons, in whom the glycosuria disappeared, and attributed the improvement to war diet. Four mild cases of diabetes reported by Klemperer became free of sugar in the course of the war. In four moderately severe cases there was a distinct increase in the carbohydrate tolerance, which he attributed to the war bread. According to Klemperer the mortality of the severe cases has not risen. Richter found an improvement attributable to war diet in mild cases, especially in the obese and neurasthenic as opposed to the gouty. In most of the moderately severe and severe cases he found an aggravation which was most pronounced in the poorer classes of society who had to depend mainly on their rations. Küster and Wolff, even in the summer of 1916, when the meat ration was reduced, found an essential rise of carbohydrate tolerance in many diabetics, and in 1917, in spite of a 10–12-fold increase in the carbohydrate allowance, there was a still greater drop in the glycosuria on further reduction of the meat ration.

Heinsheimer found that a fair number of so-called mild diabetics became more or less free of sugar in the course of the war, but that owing to the necessity of making their food consist mainly of carbohydrates, and so exceeding their limits of tolerance, many cases which were originally mild gradually became more or less severe. On the other hand, the experience of Elias and Singer was that rationing had a favourable influence on all forms of diabetes, whether mild, moderate, or severe. Many of the cases lost their glycosuria and showed a relatively high carbohydrate tolerance. Their blood-sugar values were relatively low or normal. This favourable effect was attributed by the writers to deficiency of albumen in the war diet.

Falta, who has seen considerably more than 400 cases of diabetes during the period of hostilities, states that the course and character of the disease have in many instances been affected by the war. He has observed many examples of diabetes assuming a fulminating course. This invariably occurred after exposure to severe hardships for several months before the disease was recognized. On the other hand, he has seen mild and even moderately severe attacks of diabetes among soldiers who were for months at a time in very dangerous positions on the South-west front without the disease being essentially aggravated. He concludes, therefore, that it is not so much mental strain as severe physical hardship that is responsible for the fulminating course. As regards the influence of war food on diabetes, Falta is not so optimistic as most of the other writers. Although war diet is beneficial to the diabetic in limiting the amount of albumin, the deficiency of fat in the diet is most prejudicial. It is true that there was often a surprising disappearance of glycosuria and acetonuria, but a severe cachexia took the place of diabetes, and death was due not to coma but to inanition or active phthisis. Falta is under the impression that phthisis in diabetes, which before the war had decreased in consequence of more rational treatment, has lately become a more frequent complication.

Faroy records a case of **diabetes with pancreatic insufficiency**, which was shown by an abundant evacuation of neutral fats in the stools. After twelve days' treatment by powdered pancreas, 50 cg. of which were given three times a day, the stools were reduced from five to two a day and contained very little fat, and in another three weeks' time became normal. The polyuria however continued, and large quantities of sugar were still present in the urine. The pancreatic insufficiency was accompanied by a certain degree of enteritis, which was shown by the presence of mucus in the stools. The condition was probably one of sclerosis of the pancreas associated with diabetes, and is an example of the dissociation of the external and internal secretions of the pancreas.

In a paper on some **rare conditions met with in diabetes mellitus** Stepp records the following cases: (1) A fatal case of diabetes complicated by contracted kidney. Death was due to coma which presented the appearance of diabetic rather than of uraemic coma, the characteristic vomiting, ammoniacal oral foetor, and diarrhoea being absent. A post-mortem examination was refused. (2) Spontaneous disappearance of severe diabetic acidosis and glycosuria on the development of a rapidly progressive pulmonary tuberculosis. No hyperglycaemia was found on examination of the blood. (3) Diabetic xanthosis without hypercholesterinaemia.

The indications for **operations in diabetes mellitus** are discussed by Blum, who remarks that this may be one of the most difficult problems which the practitioner has to confront. Apart from urgent cases in which an operation is imperative, such as strangulated hernia or perforative appendicitis, hesitation may arise as to whether an operation is justifiable or as to the period at which it should be performed. The difficulties are all the greater as the diabetes and the surgical affection have a reciprocal influence upon one another and a vicious circle is created. Should the operation be carried out at once to remove the lesion and at the same time the causes which have an unfavourable action on the diabetes, or, on the other hand, should an attempt be made to render the urine free of sugar, or at least to reduce the glycosuria, so as make conditions more favourable for operation? Much may be said in defence of either step. Numerous instances have occurred of surgical affections in diabetes which have healed spontaneously after disappearance of sugar from the urine; while on the other hand it often happens that after a successful operation the diabetes takes on a mild course and shows an improvement characterized by diminution of the glycosuria and disappearance of acetonuria. The difficulty of deciding in these cases is increased by the fact that a surgical operation exposes the diabetic patient to great dangers which are chiefly connected with the anaesthetic and operative shock. Moreover, the preparation of the patient constitutes a psychical trauma which may act very unfavourably on the disease. As regards the anaesthetic, ether is to be preferred to chloroform, although the cases of diabetic coma following the use of ether are by no means rare. Spinal and local anaesthesia present certain advantages, but they are counterbalanced by the greater likelihood of shock ensuing. Blum is of opinion that in mild cases of diabetes characterized by a slight degree of glycosuria and the absence of acetone bodies, abstention is indicated, and an attempt should be made to cure the glycosuria. On the other hand, in severe cases characterized by a high amount of glycosuria and the presence of acidosis, operation should be performed as quickly as possible. The same applies to diabetes complicated by nephritis.

The question of operation in diabetes is also dealt with by Labbé, who points out that the danger of operating in this disease is due to two principal causes, viz. hyperglycaemia, which favours suppuration, and acidosis, which is a cause of post-operative coma. The choice of the anaesthetic is very important. Local anaesthesia by cocaine or its substitutes, or, failing that, spinal anaesthesia, is indicated; if a general anaesthetic is absolutely necessary, ethyl chloride should be used. Chloroform or ether should never be given to diabetic patients with acidosis. Unless the operation is urgent, it should be preceded by special treatment to combat the hyperglycaemia, consisting of (1) a mixed regimen containing only a small quantity of meat and a reduction of carbohydrates, if the patient has no acidosis. (2) A diet consisting of dry vegetables, oats, or milk, if the patient has acidosis. (3) Bicarbonate of soda in sufficient doses to render the urine alkaline. The usual starvation before operation should be avoided. After the operation bicarbonate of soda should be given by mouth or intravenous injection to keep the urine alkaline. As soon as the patient can eat he should be given vegetable broth, oats, dry vegetables, and milk, and the alkaline treatment should be continued until the acidosis has disappeared.

In a paper on diabetes in surgical diseases, read before the Kiel Medical Society on March 20, Weiland stated that careful investigation of 83 cases of various injuries yielded the following results: In 40 cases the urine and tolerance for sugar were normal, in 3 there was diabetes which had been present before the injury without the patient being aware of it, in 5 cases of relatively slight injuries without cerebral commotion there was an alimentary glycosuria, and in 35 cases, principally of commotion, there was a spontaneous glycosuria with hyperglycaemia without diabetic symptoms.

This glycosuria appeared at once or a few days after the injury, and lasted for at least ten days. The urine showed on an average 0·1–0·5 per cent. sugar (in an exceptional case 2·6 per cent.), with a total daily output of 8·50 grm. Acetone could not be found in any case. The glycosuria bore no relation to the severity of the injury, nor was there any parallelism between the amount of sugar in the blood, which in these cases was on an average 0·375 per cent., and the amount of sugar in the urine. The cause of the appearance of the sugar in all these cases might be regarded as a nervous irritation of the region of diabetic puncture by fat emboli or a disturbance in the conductivity of the nerve tracts by commotion. The disturbance was always of a transitory nature, and did not entitle the patient to compensation or furnish any grounds for attributing a subsequent diabetes to the injury. Weiland regards it as advisable, in every case of injury, to carry out simple tests for spontaneous and alimentary glycosuria. Among 48,000 admissions, there were 328 diabetic patients with surgical complications such as appendicitis, cholelithiasis, erysipelas, abscesses, cellulitis, boils, cataract, otitis media, and especially gangrene. The mortality among these cases was 46 per cent., as compared with a mortality of 24 per cent. among diabetic patients without surgical complications. In all the 328 cases, however, the diabetes had received little or no treatment. When the disease was properly treated, necessary surgical intervention did not cause a rise in mortality. Four patients with diabetic coma were admitted with the mistaken diagnosis of intestinal obstruction and peritonitis, and were operated on at once, with a fatal result in each case. Only absolutely necessary operations should be performed on diabetics. Carcinoma should be treated by radium or X-rays. Chloroform should always be avoided as an anaesthetic. Apart from unrecognized and untreated cases, the danger of operation in diabetes was due on the one hand to coexistent diseases such as arteriosclerosis and a failing heart, and on the other hand to the tendency of diabetics to coma. Contrary to what was formerly held, hyperglycaemia in itself is no contra-indication to operation.

In a paper entitled 'Is the glycosuria occurring after accidents diabetic?' Schweriner and Selberg record their observations on 13 airmen who had 'crashed'. In seven cases spontaneous or alimentary glycosuria was found, but no true instance of diabetes. The occurrence of glycosuria was independent of the character and severity of the injury, and there was no obvious association of glycosuria with a renal injury. On the other hand, in some cases of renal lesions there was no glycosuria, and in others glycosuria was either not associated with any renal lesions or did not appear until all microscopical evidence of albuminuria had disappeared. The glycosuria was therefore attributed to the extraordinarily severe psychical trauma. The amount of glycogen in the urine was always very slight and independent of the diet, being thus fundamentally different from diabetic glycosuria.

Gallus, an ophthalmic surgeon at Bonn, discusses the question of **diabetic cataract** in a paper based on the study of 609 cases of diabetes, 410 of which occurred in men and 199 in women. Cataract was found in 32·5 per cent., or in about a third of the cases, and was undoubtedly the most frequent eye disease among these patients. While the number of diabetics increased regularly with each decade, cataract was found to be rare before 50, and to become frequent after that age. This does not agree with the general view that cataract is frequent in juvenile diabetes, and is all the more remarkable as the juvenile form of the disease is the most severe. Gallus also found that certain forms of very severe juvenile diabetes complicated by retrobulbar neuritis, which was undoubtedly due to the metabolic disturbance, showed an immunity to cataract formation. In numerous cases of this kind under 50, there was not a single instance of cataract. In addition to the 609 cases already mentioned, 76 cases of diabetes in soldiers were examined, 73 of whom were under 50, and only one of them, a man aged 24, was found to have cataract, whereas 14 had retrobulbar neuritis. To solve the question whether and to what extent diabetic differs from senile cataract, a series of 1,089 non-diabetic cases, of whom 738 were men and 351 women, was used as controls, and it was found that the frequency curves of cataract ran parallel in the diabetic and non-diabetic cases, and that in both a rise occurred between 50 and 60. Separation of the cases according to sexes showed the surprising fact that women had a much greater tendency to cataract formation than men, both as regards senile and diabetic cataract. There was nothing characteristic in the clinical or pathological appearances of diabetic cataract. The duration of the diabetes had no obvious influence on the development of cataract, and anti-diabetic treatment did not tend to clear up the opacity in the lens. Gallus's cases, therefore, do not confirm the generally accepted view that diabetes as such is responsible for the undoubtedly frequent occurrence of cataract in that disease. The question 'Is there such a thing as diabetic cataract?', which formed the title of the paper, must be answered in the negative. There is no doubt, however, that diabetics develop senile cataract more frequently than non-diabetics, and that in both cases women show a greater tendency to cataract than men. The greater frequency of cataract in diabetics is to be regarded as a pre-senile phenomenon, and the predominance of it in women is probably due to the earlier climacteric in that sex. Hereditary factors also play a part in the causation of cataract in diabetic patients, in the sense that, either by direct inheritance or as the result of certain diseases in the parents, the lens offers a diminished resistance or has a shorter duration of life.

The question of **the relation between diabetes mellitus and diabetes insipidus** is discussed by Lewin, who reviews the cases on record of supposed transformation of one form into the other. If Eric Meyer's view, which is held by most clinicians, be accepted, that diabetes insipidus is a primary polyuria caused by inability of the kidneys to produce a urine of normal concentration, there is not a single case on record of transformation of one form of diabetes into the other, especially of diabetes mellitus into diabetes insipidus. It is well known that after cessation of glycosuria as the result of suitable diet, the diabetic patient very often passes large quantities of urine. This polyuria, however, which persists for a long time, should not be regarded as diabetes insipidus. Lewin emphasizes the fact that in none of the cases so described is the diagnosis of diabetes insipidus confirmed. This criticism applies both to the cases of supposed transformation of diabetes mellitus into diabetes insipidus, and to the much less frequent cases of transformation of diabetes insipidus into diabetes mellitus.

The association of **glycosuria and acromegaly** has long been known. Pierre Marie, in his original description of acromegaly, stated that glycosuria was found in at least half the cases. More recently Launois and Roy collected 16 instances of diabetes and giantism. In most of the cases published, including that reported by Labbé and Langlois in a man aged 48, the diabetes was not accompanied by loss of flesh or acidosis. The fact that the glycosuria sometimes reaches a very high figure is due to the fact that the patients as a rule are large eaters. In a large number of cases the glycosuria disappears under a suitable diet, or ceases before death as the result of the reduction of food. As a general rule, there is a close relation between the glycosuria and polyuria: when the hyperglycaemia falls as the result of a reduction of the carbohydrates in the diet, the glycosuria diminishes and the polyuria as well, and disappearance of the glycosuria is usually accompanied by that of the polyuria. In Labbé and Langlois's case, however, the polyuria remained the same, while the glycosuria diminished, and even after complete cessation of the glycosuria the polyuria was still about 3,000 c.c. There was thus an association and relative independence of the three syndromes, acromegaly, diabetes mellitus, and diabetes insipidus. Treatment by pituitary extract had no effect on the glycosuria or polyuria. The case, therefore, is not in favour of a glandular pathogeny for diabetes or polyuria, but tends rather to support Loeb's view that the polyuria and glycosuria are due to an irritation of the brain in the neighbourhood of the hypophysis.

Williams and Humphreys (1), who have studied the **blood-sugar** levels in 127 cases of diabetes, emphasize the distinction between the blood-sugar level and the renal threshold for sugar. The height of the blood-sugar level at which appreciable quantities of sugar are eliminated in the urine is the renal threshold. The blood-sugar level in the various stages of diabetes may be much higher or lower than this point. There is no striking relation between the height of the renal threshold and the duration of the disease. In 65 cases, however, it was found that the threshold tended to rise with the increasing duration of the disease. Younger diabetics as a rule have low or normal thresholds, and the threshold rises with advancing years. When the diabetes is mild or quiescent, the point at which the kidneys eliminate sugar is stationary, but when the disease becomes progressive the threshold tends to rise. A rising renal threshold for sugar in spite of careful dietary treatment is a serious prognostic sign, and in mild diabetes usually indicates some complication such as arterial hypertension. A high renal threshold for sugar may mean a physiological expedient to conserve food material. The writers believe that persistent high blood-sugar levels promote exhaustion and rapid decline of function, and the high threshold is merely a safety measure. In severe diabetes, when extremely low diets are necessary to maintain life, the high threshold is essential to take care of the seriously impaired carbohydrate metabolism. In the treatment of diabetes the blood-sugar level should be maintained as nearly normal as possible, even though severe restrictions in diet may be necessary, notwithstanding the fact that a high threshold will permit of a much more liberal diet without the appearance of sugar in the urine. The writers hold that diabetes should be controlled on the basis of the blood-sugar level, rather than by urine tests. A persistently low blood-sugar level is an extremely favourable prognostic sign, while a persistently high blood-sugar level in spite of undernutrition usually indicates an unfavourable issue. In their experience, cases which had hitherto been intractable, and had shown progressive loss of food tolerance when the blood-sugar level was disregarded, have been greatly benefited and the tolerance increased by regulating the food intake so as to ensure when possible a normal blood-sugar level. While they regard 0·15 per cent. as the maximum normal digestion blood-sugar level, they believe that patients are safer when this level is not higher than 0·13 per cent.

Williams and Humphreys (2) regard the glucose tolerance and utilization test proposed by Hamman and Hirschman, and modified later by Janney, as an extremely useful procedure in differentiating those metabolic disorders in which traces of reducing substances are excreted in the urine from renal diabetes and mild diabetes mellitus. As a means of measuring the disturbance in carbohydrate metabolism, in hyperthyroidism, and other endocrinic disorders, it is much superior to tests depending solely on the determination of urine sugar. Renal diabetes is a definite physiological disturbance easily distinguishable by this procedure from true diabetes. The sugar tolerance and utilization test is particularly useful in differentiating those cases of very mild diabetes in which there are no clinical symptoms. The various degrees of failure of carbohydrate metabolism in the more evident cases of diabetes are most strikingly shown by this method.

**Renal diabetes.** Bailey defines renal diabetes as a condition of glycuresis not dependent upon a temporary increase in blood-sugar in an individual free from symptoms of diabetes mellitus. The condition can be recognized by morning synchronous blood and urine sugar tests, the specimens being collected before the patient has had anything to eat or drink. At least two types can be recognized: (1) cases with normal or subnormal blood-sugar and glycuresis which is greatly influenced by blood-sugar changes; (2) cases with a constant glycuresis which varies with the rate of urinary excretion and is little influenced by blood-sugar changes.

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## DUCTLESS GLANDS

**Thyroid.** In an examination of 65,507 men between April 1 and September 1, 1918, Smith found enlargement of the thyroid in 1,074 instances, or in 1·63 per cent. In 116 cases (10·7 per cent.) there were toxic symptoms such as irritability, palpitation and nervousness, shortness of breath on exertion, hyperidrosis and hot flushes of the face and hands. These men were rejected with a diagnosis of exophthalmic goitre or hyperthyroidism according as exophthalmos was present or not. The diagnosis of toxic goitre from irritable heart was often difficult, but some help was afforded by the study of the blood-pressure. The systolic pressure was not usually raised in irritable heart in which there was no organic basis, whereas 73 per cent. of the men with hyperthyroidism had systolic pressure of over 130 mm. and 51 per cent. over 140 mm. Hg. In doubtful cases the history and eye-signs were the determining factor, and an increased systolic pressure was supporting evidence in favour of hyperthyroidism.

In examination of recruits drafted from the North-West for the United States Army, Brendel and Helm found a remarkable quantity of thyroid enlargements. Many were unassociated with toxic symptoms, but it soon became evident that a considerable proportion had true hyperthyroidism and were unfit for general military service. Locality proved to be a much more important aetiological factor than family history. The figures showed that there were definite goitre districts in Oregon and Montana, and probably in Nevada. In addition to the ordinary symptoms, the more toxic cases showed a tendency to nephritis.

In a paper based on the study of 50 cases Johnson draws attention to the frequent occurrence of definite symptoms of hyperthyroidism in exhausted soldiers. In the first two cases exophthalmos was pronounced, and there was definite enlargement of the thyroid gland. In five other cases only was there any enlargement of the gland, and in these the enlargement was limited to one or other lobe. In the remaining 43 cases the thyroid did not show any alteration in size, but there was more or less exophthalmos, as well as palpitation, tremor, headache, disturbed sleep, nervousness, and digestive disturbances. Rapid improvement followed rest in bed, with a full diet and tonics and an occasional sedative. Johnson attributes the condition to an accumulation in the body of toxic substances due to the prolonged hyperactivity of the thyroid during life in the trenches.

Micheleau records three cases of exophthalmic goitre in soldiers. In the first case the symptoms appeared after the battle of the Marne, and in the second after a shell wound, gas poisoning, and two attacks of bronchitis.

In the third case no immediate cause could be discovered, unless nightmares could be regarded as a factor. In Micheleau's experience exophthalmic goitre is a rare occurrence in soldiers. The best results were obtained by rest, isolation, and the administration of quinine sulphate and sodium salicylate, either separately or in combination.

A case of rapid increase in size and transformation of an ordinary goitre after the first few months of war into exophthalmic goitre is reported by Latronche in a soldier aged 26. Complete recovery followed removal of the goitre.

Étienne and Richard (1) have seen several instances of Graves's disease, due to bombardment by heavy guns or aeroplanes. In two cases which occurred in women, aged 24 and 34 respectively, the symptoms developed suddenly as the result of a fright, and in each case were associated with a rise of blood-pressure which indicated an excessive secretion of adrenalin. In two other cases, however, of Graves's disease due to emotion caused by the bombardment of Paris, the blood-pressure was lowered. The dysthyroidism of Graves's disease is not, therefore, necessarily associated with suprarenal overactivity. Moreover, in some cases, as in those recorded by Ramond (vide *Medical Supplement*, 1918, **1**, 13), an 'Addisonian syndrome' may be grafted on a pre-existing Graves's disease.

Étienne and Richard (2) report another case in which a subject of Addison's disease suddenly developed symptoms of Graves's disease as the result of an explosion in a munitions factory. After three months' rest the symptoms of hyperthyroidism disappeared and death was due to Addison's disease.

Railliet relates the case of a soldier, aged 27, who, after an emotion and contusion caused by a shell explosion close at hand, developed sweating, tachycardia, palpebral oedema, and enlargement of the parotids. The last two symptoms were probably due to a vaso-motor hyperaemia which, as Chauffard and Monnot have shown, may be associated with Graves's disease.

Lian attaches considerable value to hyperaesthesia of the thyroid in the diagnosis of incomplete Graves's disease. A large number of cases of tachycardia of an apparently neuropathic character, especially those grouped together under the name of 'soldier's heart' or 'war heart', are really due to Graves's disease, although there may be no enlargement of the thyroid or exophthalmos. Minor signs, however, of Graves's disease may be present, such as von Graefe's, Stellwag's, and Moebius's signs. Hyperaesthesia of the thyroid region is best shown by drawing the point of a pin over the skin of the neck, when the patient experiences a sharp pain or burning feeling in the thyroid region. Out of 10 cases in which Lian recently noted hyperaesthesia of the thyroid region, in only three, in which there was a distinct enlargement of the thyroid, could the diagnosis of Graves's disease have been made without this sign, while in the seven others the signs were suggestive but not indisputable. In fully-developed Graves's disease, when the resistance of the capsule is finally overcome, the goitre is not painful, whereas in the early stages, when the thyroid is beginning to increase in size, distension of the capsule gives rise to pain.

At a meeting of the Vienna Medical Society, on January 24, Falta showed a case of Graves's disease with unilateral exophthalmos. The patient was a man aged 59, who had been suffering from palpitation for several years. Headache, insomnia, tinnitus, and loss of hair developed, and one night enormous exophthalmos of the right eye occurred. The other symptoms were tremor of both hands, moist skin, rapid pulse, and slight enlargement of the middle lobe only of the thyroid. There was no reason to regard a tumour as the cause of the exophthalmos. The X-rays showed a completely normal orbit. On the other hand, the rapid appearance of the proptosis and the whole history of the case were in favour of Graves's disease. Unilateral exophthalmos in Graves's disease is not uncommon. Sattler has collected 109 cases, in several of which, like the present case, the enlargement of the thyroid was only just perceptible. Cases are also on record in which the exophthalmos developed with equal suddenness.

The cutaneous complications of Graves's disease are discussed by Du Castel, who classifies them as follows: (1) Vaso-motor, (2) Trophic, (3) Toxic, (4) Microbial.

(1) The vaso-motor changes consist of transient flushing of the face, followed by oedema or, much less frequently, purpura. The oedema is usually solid, resembling myxoedema or sclerodermia.

(2) The trophic disorders are chiefly represented by anomalies of pigmentation, such as melanodermia or vitiligo and sclerodermia. Alopecia, atrophy of the nails, and dental caries also belong to this group.

(3) The toxic disorders include erythema, urticaria, pruritus, eruptions resembling rubella, and eczema.

(4) The microbial complications consist of pyodermia and furunculosis.

Disturbances of the function of the thyroid gland, both in the form of Graves's disease and of myxoedema, show a well-marked predilection for the female sex. According to Aschner, 80 per cent. of all myxoedematous cases occur in women. Of 150 cases of myxoedema reported by Heinsheimer 117 were women and only 10 men. The predominance of married women is remarkable. Of 78 cases of myxoedema recorded by Hunn and Prudden 14 were unmarried and 64 married, the latter having had a total of 300 children and 29 abortions, or an average of five pregnancies each, before the development of myxoedema. Although the close relationship of the female sexual organs with myxoedema is well established, the fact that the cessation of their function may lead to considerable interference with the function of the thyroid appears to have received little attention, Curschmann apparently being the only writer who has recorded cases in which symptoms of myxoedema developed after the onset of the climacterium. Deusch now reports a case in a woman who after panhysterectomy for fibroids developed typical myxoedema accompanied by considerable cardiac dilatation, the occurrence of which in myxoedema has recently been described by Zondek (vide *Medical Supplement*, 1919, **2**, 28 *b*), and Assmann (*ibid.*, 176 *b*). Deusch concludes by saying that in every case of climacteric neurosis a distinction should be made between purely climacteric symptoms and those due to hypothyroidism, so that when the latter are present thyroid medication should be prescribed.

In an article on the relations of exophthalmic goitre and ovarian insufficiency Tilmant records six cases of exophthalmic goitre occurring in a family in which the appearance of symptoms coincided with periods of ovarian disturbance (menopause in one case, menstruation scanty and painful in four cases, and profuse in one). Of 17 members of this family 12 had goitres, which in some were of unknown nature and in others were exophthalmic.

Léopold-Lévi (1) records three cases of irregular pyrexia in children similar to that described by Laubry and Esmein in connexion with disordered action of the heart (vide *Medical Science*, 1919, **1**, 75) and cured by thyroid opotherapy. The fever assumed one of three forms, being either transient and slight, relatively prolonged, or slight and persistent. Léopold-Lévi concludes that in children with prolonged fever without any obvious cause, besides examining the appendix, adenoids, and tracheo-bronchial glands, signs of thyroid instability should be looked for, and suggests that Laubry's and Esmein's cases were due to this cause.

**Suprarenals.** The subject of traumatic Addison's disease is dealt with by Dürck, who reports the following illustrative case. A hitherto healthy man, aged 48, was caught between a railway carriage and a revolving platform and had four ribs fractured. Apparent recovery took place, and he was able to resume his work in about six weeks, but a week later he had to give in owing to tachycardia and weakness in the arms and legs. Bronzing of the skin of the face and hands gradually set in and muscular weakness increased. Treatment consisted in the administration of suprarenal preparations, and death took place about eight years after the accident. The necropsy showed considerable bronzing of the skin of the face, hands, forearms, and external genitals, a complete absence of the suprarenals, and a healed fracture of the sixth to the ninth ribs on the right side. On microscopical examination some necrotic fragments were found representing the remains of the medulla of the left suprarenal, while on the right side there was hardly any trace of suprarenal left. Some traces of blood-pigment indicated that a haemorrhage had occurred in this situation a long time previously. Tuberculosis could be excluded, and there was no evidence of syphilis. The rarity of traumatic Addison's disease is shown by the fact that the first and hitherto only conclusive case published was that by Borrmann in 1906, in which the patient fractured three ribs as the result of a fall, and within a year after the accident developed bronzing of the face, and a month later of the buccal mucosa, followed by emaciation, weakness, gastric disturbance, and rapid pulse. Death took place four years after the accident. The necropsy showed an old fracture of the eighth, ninth, and tenth ribs on the right side, and hard fibrous masses taking the place of the suprarenals and consisting microscopically of inflammatory connective tissue with pigment granules indicating the remains of a previous haemorrhage.

In 90 autopsies performed during the war Willems and Goormantigh found traumatic lesions of the suprarenals in three cases and tuberculous lesions in four. The traumatic cases showed that lesions of this kind were encountered in crushing accidents or other violent injuries involving the dorso-lumbar region or abdominal wall. In old persons the suprarenal may be the only abdominal organ affected, as owing to its rich arterio-venous supply and its large size in old age it is particularly exposed to injuries of this kind. The four cases of tuberculous lesions of these glands occurred in soldiers who had died as the result of wounds. In three the lesion was unilateral and there was no clinical evidence of suprarenal failure. In the fourth the lesion was bilateral and had destroyed all the medullary substance. The rapid death of the patient, who had only a relatively slight wound of the lower limb, should therefore be attributed to the suprarenal lesions, especially as his symptoms—sudden and considerable fall of blood-pressure, vomiting, and convulsions—pointed to suprarenal insufficiency. The cases show that tuberculous lesions of the suprarenals are not uncommon in soldiers who are considered fit for service at the front, and that the possibility of suprarenal lesions should always be considered in certain cases of traumatic shock for which there are no abdominal lesions responsible.

A case of fulminating suprarenal insufficiency is reported by Damade. A man, aged 48, convalescent from influenzal broncho-pneumonia, suddenly complained of severe lumbar and abdominal pain, and death occurred within an hour. At the necropsy, carried out within five hours after death, the medulla of the suprarenals was quite unrecognizable, the cells being much vacuolated and showing only a thin layer of protoplasm. There were no haemorrhages or infective nodules.

Lusk and Brumbaugh record a fatal case of non-traumatic haemorrhage of the left suprarenal. As the *Streptococcus haemolyticus* was isolated from the blood both before and after death, and the case followed shortly on an epidemic of empyema due to the same organism, it is probable that this organism was the exciting cause. The symptoms up to a few hours before death were those of an acute septicaemia.

**Hypophysis.** According to Pardee, who records seven illustrative cases, the cause of pituitary headache is an enlargement of the hypophysis following a stimulus or demand made on it, or a pathological condition of the gland. It is more common in women than in men and may occur at any age, though it is most frequent in adolescent and early adult life. Its characteristic features are its situation, its duration and persistence, and its relief under specific medication. It is located between the temples, behind the eyes, and is accompanied by dyspituitary signs, especially an abundant growth of dark coarse hair on the body and limbs, change in the bony growth, and an excessive deposit of adipose tissue. The headache is very persistent, usually lasting from half an hour to 48 hours, and it may be continuous, frequently coming on in women at the time of menstruation. It often ceases very suddenly, returning again with exacerbations, and is accentuated by excitement, stooping, and ingestion of sugar. In almost every case skiagrams will show an abnormality of the sella turcica. Provided there is not a progressive neoplasm, administration of the whole gland will cure the headache and accompanying symptoms in a large percentage of cases.

Kennaway and Mottram report two cases of diabetes insipidus with data as to the composition of the urine and its molecular concentration in comparison with that of the serum. When large amounts of sodium chloride were given, the percentage of nitrogen plus chlorine in the urine remained unaltered; the kidney therefore lacked the power of concentration which is exhibited normally after ingestion of salt. The anti-diuretic effect of pituitary extract given subcutaneously was demonstrated both in a normal subject and in a case of diabetes insipidus. Administration of such preparations by mouth was ineffectual. No record was found in the literature of any case of diabetes insipidus in which abnormality of the pituitary was excluded with certainty by post-mortem examination, whereas in a considerable number of cases the disease has been associated with a lesion of the posterior lobe of the gland. Such lesions, however, are not invariably accompanied by diabetes insipidus. The evidence of morbid anatomy as to a connexion between the pituitary gland and diabetes insipidus is therefore inconclusive, but the immediate restoration of a normal state of the urine when pituitary extract is given in diabetes insipidus provides the strongest evidence for the normal activity of the gland in regulating the secretion of urine.

A case of dwarfism with atrophy of the anterior lobe of the pituitary is recorded by Simmonds. The patient was a dwarf, 110 cm. in height, who died at the age of 21 years from purulent meningitis secondary to otitis. The skin was of normal appearance and the hair of the scalp was well developed, but that of the beard, axillae, and pubis was completely absent. The testes were the size of peas, and the prostate and seminal vesicles were also infantile. The thymus weighed $2\frac{1}{2}$ grm. and was entirely fatty, the suprarenals weighed 2 grm. each, and the thyroid 2 grm., but were quite normal histologically, as were also the pancreas, liver, and spleen. The pituitary gland was remarkably small, weighing only 0·2 grm. No anterior lobe was visible to the naked eye, but the posterior lobe was of normal size and shape. On microscopical examination one large cyst and several smaller ones were found in front of the posterior lobe with some remains of the anterior lobe substance. Simmonds attributes the condition to an embolic process in the first few days of life, syphilis being excluded by the absence of induration. He contends that a destruction of the function of the anterior lobe of the pituitary in infancy may give rise to dwarfism, and in such cases administration of pituitary substance from the anterior lobe is indicated.

A familial disease resembling acromegaly and affecting four members of one family in whom it appeared at puberty is described by Oehme. It was characterized by excessive thickness of the bones of the extremities, especially of the forearms and legs, in association with a poor development of secondary sexual characteristics. The size of the soft parts was also increased, although to a less extent, especially at the distal end. There were, however, no changes in the face, and X-rays showed no involvement of the hypophysis. Oehme concludes that the condition was either a primary endogenous acromegaly of the skeleton or an atypical early familial acromegaly. The poor development of the sexual characteristics, indicating a pluriglandular affection, is in favour of the second view.

**Thymus.** Tricoire reports a case of sudden death from acute dilatation of the heart as the result of the violent exertion connected with a game of football after supper in a man aged 22. In addition to the dilatation, which was most marked on the right side of the heart, a large thymus weighing 21 grm. was found. Tricoire suggests that the hypotonus of the myocardium was caused by hyperthymia, running and digestion acting as secondary causes.

**Testis.** Hermanns records an instance of the transformation of secondary sexual characteristics in a man aged 38, apparently due to atrophy of the testicle, the cause of which was obscure. The first sign of the change was the disappearance of the moustache and eyebrows, which were very well developed, and this was followed by lack of sexual inclination and impotence. The breasts became well-developed and rounded like a woman's. The occurrence of such cases has been attributed by Biedl to the presence of more or less developed rests of heterosexual internal secretory tissue elements in the sexually differentiated sexual glands, these rests under certain conditions becoming predominant.

**Ovary.** Hopkins records five cases illustrating a type of high blood-pressure developing in women at the time of the menopause, in which there are no discernible arteriosclerosis, at least for some years after its onset, no renal involvement, and frequently no symptoms of any kind for possibly a decade or longer. At the menopause, with the withdrawal of at least a part of the internal secretion of the ovary from its place in the chain of the endocrine glands, a certain amount of depressive influence of the ovary is withdrawn from the adrenals, hypophysis, and thyroid, leaving them, as it were, out of balance. As substances are produced in one or more of these glands, which increase blood-pressure, influence the sympathetic nervous system (vaso-motor system) and the sex glands, aid in regulating metabolism, and are intimately connected with emotional disturbances, Hopkins suggests that the blood-pressure is raised and sustained at a high level by a combination of these altered influences. A persistently high pressure of this type will produce fibrosis of the vessels, though in a few instances patients may reach 60 years and over without the slightest evidence of peripheral or retinal sclerosis.

**Pluriglandular syndromes.** Under the title of endocrinic pseudo-influenza Léopold-Lévi (2) describes a number of cases resembling influenza by the symptoms of headache, lassitude, and congestion of the conjunctival, nasal, pharyngeal, laryngeal, and tracheal mucous membranes and differing from it in the absence or slight degree of fever, the rapid course, tendency to recurrence or periodicity, and appearance among those who had already had influenza. In these cases the actual condition is one of disturbance of the thyroid, ovarian and suprarenal function, and can be cured by thyroid and ovarian opotherapy.

Hazen reviews the literature relating to affections of the endocrine glands in acquired syphilis, and remarks that syphilis of these glands is an almost unknown disease. It is impossible to say how far syphilis is responsible for such secretory abnormalities, for the case reports of ductless gland diseases rarely make any mention of a search for syphilis.

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## INFECTED KNEE-JOINTS

The *Medical Supplement* contained reports of the treatment of wounds of the knee-joint in Germany during the early part of the war. The aim of the present review is to describe the treatment which prevailed during the latter part of the war, having especial regard to the application to civil practice of improvements made in the surgical treatment of infected knee-joints.

An enormous number of wounds of the knee-joint have occurred. Only second in importance has been the infection of the joint through the blood-stream and extension to it of infection by continuity.

In civil practice the second class, the infections through the circulation, will be the most frequent; next, the extensions by continuity. The wounds of the joint will be very important, although less common.

It is necessary as a preliminary to refer to nomenclature, for it is only by the context that one can reproduce the precise meaning of the statements made by some of the writers. There is the confusion caused by using both the old and the B.N.S. anatomical nomenclature, e.g. when employing the term median as applied to the posterior vertical line down the middle of the popliteal space, and mesial or medial applied to the internal condyle and other structures between the middle line of the popliteal space and the imaginary vertical middle line of the body.

Next as to the varieties or degrees of infection. Some writers do not clearly distinguish infective synovitis (infection limited to the synovial membrane and giving rise to an infected effusion into the joint) from infective arthritis (infection of the synovial membrane and of the subsynovial fibrous capsule). This latter degree of infection is also referred to under the term capsulitis, capsular cellulitis, panarthritis. As to panarthritis it must be impossible to have a partial infection of the knee-joint; the joint must be always infected as a whole, although infected fluid may collect more in one part of the joint than in another. Capsular cellulitis should imply not only an inflammation of the fibrous capsule but also of the cellular tissue, i.e. the loose connective tissue around the joint outside the capsule.

Infective osteoarthritis would seem the clearest term for all cases where there is in addition infection of the joint ends of the bones, whether this is obvious owing to a fracture, or whether there is only a crack in the cartilage and a fissure in the bone so fine as to be overlooked in an X-ray photograph.

Perforation of the knee-joint should mean that a bullet has made a hole right through and escaped by the wound of exit. Penetration of the knee-joint implies a wound of entry directly communicating with the knee-joint produced by a foreign body which may then be lodged within the joint, or in the bone communicating with the joint. Occasionally the foreign body may have passed beyond the joint without actually escaping, when the question may arise whether it is still in communication by an infected tract or whether that has become shut off. Punctured and incised wounds should cause openings of the joint without the weapon lodging. Débridement, literally translated 'unbridling', in its original sense was used by French surgeons in the eighteenth century and had for its object the relief of tension. The wound was incised in the long axis of the limbs, often through the deep fascia, because one of the objections to the practice then raised was that it induced hernia of muscles. Surgeons in the eighteenth century also cut away lacerations and the ragged edges of the wound, but that is better called paring. The excision of a wound should now mean the removal of all the injured and infected tissues, and should be restricted to that. Then it must necessarily include the removal of any lodged foreign body. An operation which falls short of that is a partial excision, and can only be properly described by stating what was and what was not cut away.

Primary suture should imply that the wound has been closed by suture at the initial operation, done within six to ten hours after the wounding. Even within those limits there are differences, whether the sutures allow fluid to escape freely between them or whether a drain is inserted, either into the joint, or only into the subcutaneous tissue. The primary suture will also differ according as it involves only the skin, or the capsule of the joint, or both. Delayed primary suture, as applied three to five days after the injury, is indistinguishable from the so-called secondary suture.

There are differences in gunshot wounds, there being at least four kinds with minor variations within each class:—

(1) Wounds from rifle or machine gun bullets or from shrapnel. Shrapnel was especially used by the British and in the earlier part of the war; hence injuries by it figure most largely in German reports; revolver bullets from heavy pistols at close quarters also caused severe injuries.

(2) Shell wounds. These were most variable in character, from injuries similar to those by bullets up to the most extensive bone injuries.

(3) Wounds in which the ends of the femur or tibia, also the patella, became involved (*a*) by a mere crack or fissured fracture, often so fine as to be overlooked at an X-ray examination; (*b*) a groove or gutter might be made in such a way that there was no tendency for the infection to spread deeper into the bone; (*c*) a foreign body entered and lodged in the bone, carrying in sepsis which might immediately manifest itself, or remain latent for a variable period of time. There was a difference between the foreign body which only did damage to the bone along its actual track, and that which caused radiating fissures or fractures opening channels for the spread of infection farther into the bone. The damage to bone might be a comminuted fracture, accompanied or not by the displacement of fragments.

(4) Wounds in which, in addition, the popliteal vessels and nerves might be injured, either by the actual missile or by the displaced fragments of bone.

One may anticipate that in civil practice the wounds most commonly seen will be punctured or incised wounds without fracture, or else crushes similar to those due to severe injuries by shell.

The examination for micro-organisms furnishes an important guide to treatment when both streptococci and gas-forming organisms are found. Then an immediate amputation is indicated in view of the danger to the life of the patient. If streptococci are found, the prognosis causes anxiety; there are variations in virulence; antistreptococcic serum should be administered at once. If the clinical signs do not quickly recede, and especially if the clinical signs become more marked, recourse should be had to amputation without delay or the patient may lose his life. When only staphylococci are present, the clinical signs and the finding on exploration must be the guide to the surgeon.

**Primary excision of the wound.** Early in 1915, as the war became one of position in France, and provision could be made for the early examination and treatment in a complete way, Gray in particular changed from the expectant attitude which authority had previously advocated. He had started with preconceived notions that suppurative infections demand long drainage, that for this drainage tubes, which must be inserted into all the recesses of the joint, are best, and that strong antiseptics are required to overcome infection. The joint was to be kept immobilized and firm; ankylosis was aimed for as the best termination attainable. Subsequently he recognized that when a case was seen early, within a few hours of the injury, to pursue an expectant line of treatment was to leave things to chance. Many cases, no doubt, escaped, but others developed infection which could not be controlled, and the patient was then likely to lose his limb or his life. The attempt to seal up the wound by treating it with pure carbolic acid or merely excising the skin margins was in most cases inadequate because infection had already entered more deeply. Matters were made worse by covering up the joint in a plaster case or by suturing the skin margins, for the retained infection then spread insidiously.

The method of excision of the wound underwent systematic development. Information was gained by X-ray examination and by examining smears under the microscope. All precautions against further infection during the operation were taken. The injured skin margins were excised; then the margins of the wound in the capsule, next the joint cavity, were washed out; after this the lodged foreign body was removed. This became the rule, for micro-organisms could always be demonstrated around the bullet even although it had occasioned no clinical signs of infection.

The greatest difficulty was found in dealing adequately with bone lesions, with the infected bone surfaces exposed by fissures and fractures. It was found necessary to gouge, to scrape freely, to remove fragments, and in the more widely comminuted cases to perform an excision of the ends of the bones forming the joint.

The next stage of the process was the arrest of haemorrhage. Many surgeons were strongly in favour of Esmarch's band. Some went further, reintroducing the bandage in addition, commencing from the toes upwards to the level of the band round the lower third of the thigh. The band was then kept on until the dressings had been fixed by a firm bandage. The objections to this course are well known. Horsley's carbolized wax for haemorrhage from the bone, fine ligatures to all bleeding points, the exact suture of the capsule and the elevation of the limb afterwards, may be considered a preferable way of preventing haemorrhage into and around the joint after the operation.

Whenever possible, the wound in the capsule should be completely closed, and no tube inserted, for a drainage tube acts as a foreign body and leads to ankylosis. When the wound in the capsule has had to be excised freely, closure may be effected by a plastic operation, making use of the slack suprapatellar portion. When the capsule cannot be shut off. it will usually be necessary to keep the knee immobilized for a long period. The skin margins should also be sutured, but if there has been considerable damage to the tissues around the joint, a drainage tube into the subcutaneous tissue, so long as it does not communicate with the joint, is unobjectionable and is preferable to a subcutaneous collection of blood or serum.

After such an operation daily inspection is necessary and a plaster case should not be applied. If fluid collects it should be drawn off. Undamaged synovial membrane, articular cartilage, and synovial fluid have within limits the property of resisting infection, as noted in a previous number of *Medical Science.* But the distension of the joint by serum prejudices absorption. Moreover, the aspiration of any fluid which collects affords an opportunity for examining the aspirated fluid for micro-organisms. If many organisms are developing, two needles may be inserted and the joint washed out with salt solution.

Gray compared 10 cases before he commenced active treatment with 36 cases after excision —

| Results | 10 cases before | 36 cases after |
|---|---|---|
| Deaths in spite of amputation | 2 | 0 |
| Amputations | 3 | 3 |
| Ankylosis | 1 | 3 |
| Doubtful mobility | 1 | 2 |
| Free mobility regained | 3 | 28 |
| | 10 | 36 |

Charles at the casualty clearing station followed Gray in excising all injured skin, fascia, capsule, and bone. He washed out with salt solution, sutured, and fixed on a splint. As soon as this procedure seemed to be about to fail, he removed the sutures and applied continuous irrigation with Dakin's hypochlorite solution. Of 20 cases, one was amputated and death followed from sepsis. The rest were transferred, a few quite healed, some discharging from a sinus, and all progressing favourably.

Lockwood's experience was at a base hospital, the cases being operated upon from two to seven days after the injury. All foreign bodies and necrotic tissue were removed: only hypertonic salt solution was used for washing out; the capsule was completely closed; the skin was sutured except for a short tube into the subcutaneous tissue. The limb was immobilized on a splint.

Lockwood's cases numbered 60. There was one death after amputation for severe sepsis. Two were amputated and recovered, one for extensive comminution and one for gas gangrene. Three became ankylosed; four had limited movement; 49 regained free movement.

Hepburn reported on 50 cases of gunshot wounds after excision, arriving at a base hospital from a casualty clearing station, 25 cases without injury to bone and 25 with injury to bone.

| Results | Cases without injury to bone | Cases with injury to bone |
|---|---|---|
| Healing without complication | 13 | 18 |
| Requiring reopening | 12 | 7 |
| Amputation after reopening | 4 | 2 |
| Died from septicaemia after amputation | 1 | 1 |

The joints requiring reopening contained streptococci and were treated by antero-posterior drainage and hypochlorite irrigation. The joints healing without complications were not moved for 10 days; in one favourable case passive movement was attempted after 5 days, but it caused a 'flair' and relapse for a month.

Dixon treated 73 cases at a casualty clearing station mainly by excision of the wound, suture, and immobilization.

Dixon's reports

| | Total | Without injury to bone | With injury to bone |
|---|---|---|---|
| All cases | 73 | 49 | 24 |
| Evacuated healing | 69 | 48 | 21 |
| Amputated | 4 | 3—2 died | 1 |
| Reports from Base Hospital | 50 | 48 healing<br>1 amputation for gas gangrene<br>1 reopened and drained | |
| Reports from home | 16 | 3 good movement<br>5 good progress<br>7 ankylosed<br>1 died septicaemia | |

Ogilvie treated 60 cases consecutively at a French hospital on the Meuse, the wounded coming chiefly from Verdun:—

| | | |
|---|---|---|
| 10 cases | No bone injury, no foreign body lodged | 6 movable joints<br>1 limited mobility<br>2 ankylosed<br>1 amputated |
| 19 cases | Foreign body lodged, no bone injury | 15 movable joints<br>2 limited mobility<br>2 ankylosed |
| 7 cases | Bone injury, no foreign body lodged | 3 movable joints<br>4 limited mobility |
| 21 cases | Bone injury and foreign body lodged | 9 movable joints<br>2 limited mobility<br>8 ankylosed<br>1 amputated<br>1 died |
| 3 cases | Severe injuries | 1 ankylosed<br>1 amputated<br>1 died |

Thus, of the 60, there were 33 with mobile joints, 5 with limited mobility, 17 had stiff limbs, 3 were amputated and survived, and 2 died.

Barling's statistics were collected at Rouen in the second half of 1916. Later on active measures were more general and more efficient. Excluded from the statistics were cases which had been treated expectantly and which had recovered without complications, also those cases which had been amputated early, as well as those cases which had died before reaching the base.

Of the total 845, 438 had been complicated by bone injury and 407 were without injury to the bone, the two varieties being approximately equal in number.

In 322 the wound had been excised and closed.
82 of these, i.e. 25 per cent., required further operative treatment.
In 336 the wound had been excised and packed, especially with salt.
128 of these, i.e. 38 per cent., required further operative treatment.
In 42 excision of the knee-joint had been done.
8 of these had to be amputated.
5 died.
In 15 there had been excision of the soft structures, partial or complete.
13 of these were subsequently amputated.
8 died.
In 130 amputation had been done—total amputations 164, nearly 20 per cent.
845

Deaths 49 after amputation.
13 without amputation.

Total 62, i.e. 7·3 per cent.

Makins included in his lecture a review of the treatment of knee-joint injuries up to the commencement of 1917, see also Campbell and Woolfenden.

**Treatment of infected synovitis or empyema without drainage.** During the war infected synovitis or empyema was produced by sepsis arriving through the blood-stream, or arose in joints which had been wounded but had been treated expectantly. The cases here referred to did not exhibit much pain; the knee-joint was more or less tensely distended with fluid, but the capsule and surrounding cellular tissue were not indurated. Aspirated fluid was found to contain staphylococci but not streptococci, the cellular content varying from turbid serum to thick pus. The general disturbance was not marked, and the chief complaint was traceable to the tension. Such cases did well when washed out, closed, and immobilized for at least ten days. The washing out was done through two needles if very thin, or, if the fluid was thick, through a cannula introduced by means of a trocar, or more generally and best through a small incision. This last was the most efficient because fibrin could be removed, and by movements of the joint the washing reached all the recesses. Of importance was the avoidance of any injury to the cartilage protecting bone, and of rubbing the synovial surface so as to start haemorrhage. There was a wide difference on the question whether any antiseptic should be used. Carbolic acid, iodine, formalin, peroxide of hydrogen, ether, soapsuds, hypochlorite were all used and advocated. Later flavine was adopted by the British and vuzin in Germany. But none of the foregoing was proved to have a clear advantage over normal saline solution. The hypertonic saline solution adopted for the purpose of exciting an exudation of lymph seemed out of place when aiming at closure of the joint. The important point after closure seemed to be to watch for any recurrence of exudation and then to aspirate, or indeed to wash out the joint again by using two needles.

In Egypt in 1916 Edington read a paper entitled 'Secondary Infections of Joints in Acute Medical Cases' which was discussed by Tubby and Choyce. Such infections might be secondary to (1) wounds and other local infections such as pyorrhoea, (2) pneumococcal pneumonia and bronchopneumonia with or without empyema, (3) gonorrhoea, (4) dysentery, (5) diphtheria, (6) erysipelas, (7) measles, (8) scarlet fever, (9) small-pox, (10) typhus, (11) typhoid, (12) malaria, (13) Malta fever.

Churchman of Yale reported a case of acute suppurative synovitis which had followed a septic wound of the leg. He drew off thick pus containing *Staphylococcus pyogenes aureus*. The joint was washed out with salt solution, then with 1 in 1,000 gentian violet, and a small quantity diluted was left in the joint. A week later clean synovial fluid, slightly stained with gentian violet, was drawn off, but no organisms were found. The washing and injection of gentian violet were repeated, after which normal movement of the joint was completely regained.

In Germany Kruger treated 50 penetrating wounds of joints, 25 of which involved the knee, by washing out and closing. He had 45 successes and 5 failures. Some of his early cases were washed out with 3 per cent. carbolic acid, most of the later ones with 1 in 5,000 vuzin.

Thöle in the course of 1916–17 among 152 cases of knee-joint wounds seen within 2 days treated 24 by irrigation only; 23 had shell fragments lodged, and 1 was a case of perforation by a rifle bullet. Of the 24, 17 healed and 7 died—4 from sepsis, 1 from sepsis and secondary haemorrhage, 1 from tetanus, and 1 from meningitis. For irrigation he used carbolic acid, or carbolic acid and camphor.

With the above may be compared v. Goeldel's cases, near the end of the war. In 11 cases he irrigated with 1 in 5,000 or 1 in 10,000 vuzin, some of which was left in the joint. He closed the capsule completely, but did not put any sutures in the skin. Some fluid was aspirated on the third day and the injection of 1 in 10,000 vuzin repeated. He did not, however, furnish evidence of mobility completely regained; his cases appeared to recover with some limitation of mobility.

Nowak in 7 cases washed out through a trocar and cannula; only 4 were successful, 1 healed after drainage, and 3 were amputated, 1 of which died. Then in 19 cases he obtained a better result; he washed out with 'Dakin's chlorine solution' through an incision, left some of the fluid in the joint, and sutured. 16 healed well, 2 healed after drainage, and 1 was amputated. In one case the washing out was repeated three times by means of a trocar and cannula.

**Infected arthritis and osteoarthritis** (capsulitis, capsular cellulitis, phlegmon, panarthritis). The chief early sign of infected arthritis is the pain which limits or prevents any movement, along with the severe disturbance to the patient generally. It is also indicated by finding streptococci on the wounded surface or in the fluid withdrawn from the joint. The swelling is not so much due to distension of the joint by fluid, as by infiltration of the fibrous capsule with fluid, which spreads out into the loose connective tissue around. The principal thing is to prevent its development; when established, the line of treatment to be adopted is exceedingly doubtful.

(1) Excision of the wound, or free opening of the joint, irrigation, and closure, may be tried in a case which has begun as an infected synovitis, not of a virulent order. If there is a wound streptococci should be proved to be absent; a gonorrhoeal infection may pursue a favourable course. An incision should be made beside the patella so as to make sure that all the contents of the joint are evacuated. The insertion of iodoform in the form of Morison's B. I. P. P. is distinctly indicated as providing a prolonged non-irritating antiseptic.

The case will require close observation. Any recurrence of exudation into the joint should be removed and the joint irrigated through two needles. The case should improve at once; if not, radical treatment, in particular amputation, must not be delayed.

(2) Drainage without inserting tubes, so as to avoid ankylosis.

A crucial incision into the suprapatellar pouch and the elevation of the extended knee has been advocated by Mayo Robson and others. The crucial incision, about 1½ inch each way, is made through the quadriceps tendon and the four angles of synovial membrane stitched to corresponding angles of the skin by fishing gut. There is no need in many cases to irrigate or sponge out the joint, and thus haemorrhage from inflamed and vascular synovial membrane may be avoided. Only when fibrin or a foreign body has to be removed need there be any exploration. Some fluid B. I. P. P. may be injected. The limb is kept raised at a right angle, or at least at an angle of 45° with the bed. After a week the sutures are removed, then massage can be begun and the patient encouraged to make active movements. This drainage has succeeded admirably in selected cases, and complete mobility may be restored. Failure is likely when the infection has invaded bone or spread through to the popliteal space.

Attempts to drain posteriorly, keeping the leg extended and horizontal, but without inserting tubes, is a doubtful expedient. Kroh described the opening of the retrocondylar pouches through lateral incisions. On the inner side an incision was made between the tendon of the adductor magnus in front and the sartorius tendon behind through a pad of fat, so as to cut into the capsule at the posterior edge of the inner condyle. On the outer side the incision is made between the iliotibial band in front and the tendon of the biceps behind, when the retrocondylar pouch can be opened just behind the outer side of the external condyle.

But this was found not to afford free drainage from the anterior and intercondylar recesses of the joint. Hence, Läwen proposed, in addition to the foregoing incision into the retrocondylar pouches, to remove the hinder end of each semilunar cartilage and to cut off a cap of cartilage and bone from either condyle.

(3) The drainage of the knee-joint leaves much to chance; pus collects in recesses, and tends to spread through the capsule into the popliteal space, or lower third of the thigh. Ankylosis must be expected, indeed remnants of the infecting micro-organisms remain latent in the capsule and are stirred up by any attempt at movement. Only in a minority of young and favourable cases, after the joint has been kept extended for some time, mobility may be regained by very gradual active movements on the part of the patient.

The insertion of tubes across the anterior part of the joint under the patella is unsatisfactory because the tubes are continually blocked by fibrin. Continuous or frequent intermittent irrigation may succeed. But since its advocacy by Harold Barnard antero-posterior drainage has been more generally practised. Barnard cut down upon the inner condyle between the sartorius and gracilis tendons whilst the knee was fully extended so that the back of the internal condyle could be felt. Then the knee was flexed a little to relax the inner head of the gastrocnemius, when the retrocondylar pouch could be incised and a tube pushed through from front to back. The internal popliteal nerve is well to the outer side of this incision near the middle line of the popliteal space. The outer retrocondylar pouch can be exposed by an incision to the inner side of both the biceps tendon and the external popliteal nerve.

(4) Free exposure of the knee-joint. Barnard said that in the case of a child in whom lateral drainage and continuous irrigation had failed, Eve had laid open the joint by a transverse incision through the patella, and then fully flexed the knee.

Whitehead, in a case in which infection had followed the removal of a semilunar cartilage and in which drainage had failed, laid the joint open by dividing the patella transversely and flexing the knee. He then removed the semilunar cartilages and crucial ligaments and after flexing the joint packed it with gauze. After ten days the joint was straightened and the granulating surfaces united so that the patient recovered with a firmly ankylosed straight knee.

Since then this operation has been often repeated; it succeeds if the bone has not become infected and if there is no spread into the popliteal space. The knee must be straightened within a week or ten days, otherwise the tibia will become displaced backwards.

If the joint is kept extended, the best measure is continuous irrigation after the Carrel-Dakin method. Packing with iodoform gauze or with salt is not so good when the joint is extended, for then pus tends to collect behind.

Instead of cutting across the patella, many prefer to turn up a rectangular flap, by cutting through the tubercle of the tibia. The lateral incisions must be continued far enough up to expose freely the suprapatellar pouch. Longitudinal anterior incisions have been tried, by passing to one side of the patella and its ligament by Petit, or dividing through the middle of the bone by Robinson. Spitzy divided the patella on the flat by exposing the bone through a curved incision, applying the saw to the upper end of the bone at the insertion of the quadriceps extensor and sawing from above downwards and backwards in such a way that the anterior and lower part of the patella remains connected with the ligamentum patellae.

Robert Jones for ankylosis recommends the straight position, and opposes the suggestion that the knee should be kept a little flexed. The ankylosis is often fibrous and so there is a danger of further flexion. In other cases some movement may be regained later, but then the patient must be able fully to extend the joint. He did not mention the danger of genu retrorsum which some put forward as liable to occur when the knee is kept fully extended.

**Excision of the knee.** Excision of the knee as an alternative to amputation has continued as before an operation of doubtful expediency. Whether primary, partial, or regular, or secondary it is much more dangerous to life than amputation unless success is complete, i.e. osseous union is attained between the femur and tibia in a straight line, without any persisting sinus. The firm osseous union cannot be ensured after the age of 30; after that the line of union generally tends to yield. Some surgeons have tried excision even when shortening of more than three inches was entailed. Others lay stress upon the advantages of a Stokes-Gritti amputation and of a modern artificial limb over a poor excision. As against this last opinion it has been found that men who have been amputated and supplied with such an artificial limb, when they resume work, tend to discard it for a peg or pillion. The procedure in infected cases, whether the excision is primary or secondary, is to fix the limb with the ends of the bones apart and institute Carrel-Dakin irrigation, then, when granulations have sprung up, to allow the ends to come into contact. It is a course of treatment which requires constant supervision to keep the femur and tibia in correct alignment.

Cases illustrating the heavy mortality after excision have been published by Thöle. Of 28 cases, 17 healed and 11 died, 10 of sepsis and 1 of communication with the popliteal artery.

Propping had 21 cases of excision, partial and irregular, 9 healed with ankylosis, 9 were subsequently amputated, and 3 died. Of the 9 amputated 5 healed and 4 died.

Pribram did 10 excisions, 3 healed and 7 were subsequently amputated.

Rankin practised excision on 29 selected cases, 17 were sent to England with good union and shortening of 2–2½ inches, 3 were progressing, 3 were subsequently amputated and survived, and 6 died. The after treatment adopted was the Carrel-Dakin irrigation, or the application of B. I. P. P. The surfaces were kept well apart until granulations had formed.

Fullerton did excision on 22 cases before the 3rd day of injury; no amputations and no deaths followed. Among 42 cases excised between the

3rd and 25th day after being wounded, 2 died of shock following the operation, and 13 required subsequent amputation, of which 4 died. He made an anterior rectangular flap, removed the condyles of the femur above the level of the articular cartilage as well as 2 inches from the tibia. The limb was fixed on a Thomas's splint with extension, and the ends not allowed to approximate until all suppuration had stopped. There was a later report in only one case; the wound was entirely healed and the leg was fixed in a case. It will be noted that a good deal more than 3 inches of shortening was produced.

Vaucresson in reporting three cases said that in May 1914 a case of excision of the knee for tuberculous disease exhibited to the Société presented 16 cm. of shortening. It was then the general opinion that excision should give place to amputation when shortening beyond 10 cm. must be expected. But there had been excisions following gunshot injuries in which, although the shortening had exceeded 10 cm., a firm union resulted with a straight leg and a good foot, and the patient walked well with a high boot. In the first case excision was done 30 hours after injury by shrapnel and there had followed firm union without complications. There was shortening of 7·7 cm., but the functional result was excellent. In a second case the already infected knee was excised on the third day, and after some inflammatory complications requiring a further operation, sound healing occurred with 12 cm. of shortening. Two years later the man was working as an indoor servant at a Lycée, but thought of leaving because the stairs were too many and there were too many floors to beeswax. A third case was that of an officer who refused amputation, so 24 hours after being wounded the knee was excised; firm and straight union followed with 14 cm. of shortening. But this was not without complications. The removal of two silver wires six weeks after the excision was followed by erysipelas and septicaemia from which the patient nearly died. After this a sinus persisted for some time. In the end the officer could walk 5 or 6 kilometres without fatigue.

**Movement of the joint.** Experience during the war confirmed, in the opinion of most, that generally held before. Willems of Ghent was exceptional in advocating active movement from the first.

A child with tuberculous disease, operated upon by arthrectomy and the joint kept straight for two years, has then been able to regain mobility by active movement without incurring any relapse. The same has happened after some of the milder cases of infected synovitis, e.g. due to gonorrhoea in older patients. After long fixation, the patient has gradually regained free movement. The cases which 'the bone-setters' cure are not infected cases. If forced movements are attempted after tuberculous and other infections the results may be bad. For instance, a lady had her knee fixed in a good straight position at the age of 20, following tuberculosis. At the age of fifty the knee was forcibly moved and suppuration ensued. When seen there was pus occupying the lower third of the thigh with some caries of bone. Amputation had to be done through the middle of the femur and it was fortunate that she recovered.

Reports of early movement after gunshot wounds state that it is generally followed by a 'flair' and relapse. In most cases no movement was allowed until the joint had become quite quiet, not at least until after ten days from the operation. Then, no forced passive movements are to be made, but the patient encouraged to try what he can do towards flexion without hurting himself. In any case after trying to flex, it is necessary for the knee-joint to return to full extension until the next attempt at movement. Gentle extension can be adopted by means of pulleys and weights against which the patient pulls when trying flexion. Everidge for this purpose modified the Thomas's splint by inserting a hinge behind the knee. This facilitated slow movements of flexion and extension by the patient and the weight against which the patient drew in flexing was gradually increased. Thus in knee-joints which were quiet after 10 days almost painless movement could be carried out without inducing any inflammatory reaction.

Willems began his practice of making his patients move the knee at once in 1909 with cases in which he had aspirated and removed blood-stained fluid. He ordered them to walk immediately. In December 1917 he communicated to the Société de Chirurgie five observations in which he had removed foreign bodies, and in January 1919, 13 cases in which he had excised a semilunar cartilage and tags. These patients had been induced to move the knee immediately after the operation in order to avoid atrophy of muscle. Movement, he contended, would not start infection; unless there is infection, movement will not make things worse. Among the cases were some in which fluid escaped between the sutures; in others aspiration was necessary. Even so it would be necessary to have later reports as to whether such cases presented any weakness of the joint, or were liable to synovitis from slight causes. Of much greater interest were his cases in which there was infection, of the character described above under infective synovitis and empyema. Willems began by a vertical incision beside the patella, generally under spinal anaesthesia, and then made the patient flex the limb beyond a right angle. The active contraction of the muscles surrounding the knee tended to empty the knee-joint of pus. Urged to do so by the nursing sisters the patients made this active movement several times a day and so good movement was regained. Willems said that it was a relatively painless process if begun immediately after the operation, but it required an exercise of the will on the part of the patient. The novel discovery by Willems is that active flexion can squeeze out and empty the knee-joint, the pus being driven out in a jet. Several French surgeons have reported cases in confirmation of Willems's. Cotte's experience on the Macedonian front exhibits the limitations of the proposal.

Bretonville and Guibé reported the following cases:

(1) An artilleryman aged 27 had been injured by a shell at Mount Kemmel which caused a wound of the buttock and a partial fracture of the ilium, which was followed by a sinus leading down to the fracture. An incision and scraping of this sinus set up a severe septicaemia, streptococci were found in the blood, and three weeks after the operation the knee became distended with pus containing streptococci. An incision was then made into the upper and outer angle of the synovial cavity; no drain was inserted, but from that day onwards the patient himself made active movements of flexion and extension which he was able to do almost without pain. The temperature the following day reached 39°, a week later it had become normal. At first there was a free discharge, but this soon got less and in a month the incision had healed. The knee could then be fully extended and it could be flexed until his heel touched the back of his thigh. There was still some muscular wasting. Two months later the

knee-joint was quite free from fluid, but the thigh of that side was 2 cm. less in circumference.

(2) An infantry corporal aged 30 was wounded in many places by the bursting of a shell. The upper part of the left fibula was involved and there was paralysis of the external popliteal nerve. The nerve was sutured and the wound pared and sewn up. The wounds suppurated, including that over the fibula, and the suppuration extended to the knee-joint so that a month after the wounding pus was drawn off. Bretonville then cut into the joint above and external to the patella. The pus contained streptococci and diplococci. The patient did not make active movements so early and so freely as in the former case, but the discharge, after being abundant, gradually dried up so that a month later the incision had healed. He could then extend and flex the knee as in the former case and walk, except that paralysis of the external popliteal nerve persisted with consequent muscular atrophy.

Abadie reported a case treated by Willems's method who had received many wounds on all four limbs, including the thigh and leg on the side of the affected knee; also the astragalus had been removed from the foot. All the wounds were suppurating freely when he came under Abadie four days after being injured. Three weeks later acute suppuration supervened in the knee by extension from a neighbouring infected wound. An external incision was made and active movements were commenced on that day with the aid of the nurse. The knee was moved four to six times a day, each time the movements being stopped when no more pus spirted out. The pus became thicker and scantier, and finally the wound healed. There was complete recovery of movement.

In another case the method failed; it was only by keeping the joint fixed that the temperature and pain subsided, and healing with ankylosis set in.

Abadie's conclusion was that Willems's method should be tried.

A man aged 36 had had for four days an acute inflammation of the knee. He had received no injury and no explanation whatever could be given as to the cause. The thigh was already wasted, the temperature was between 39° and 40° and the pulse 120. Marmontel laid open the synovial membrane and creamy pus escaped. He fixed the synovial membrane to the skin by four fishing gut sutures. Movements were begun on the fifth day and were made four times a day. The wound had closed in three weeks, and the patient left hospital at the end of a month walking well and able to flex the knee to less than 135°.

In Acevedo's case a machine gun bullet had penetrated the outer side of the knee and caused a comminuted fracture of the external condyle, after which it had lodged in the quadriceps extensor. 38 hours after being wounded the joint was washed out with ether and the bullet extracted. Movements were begun the same day; they occasioned no pain, indeed the patient was relieved. Complete movement was soon recovered and the patient got up 14 days after the operation.

Michon reported a case in which fragments of shell and clothing had been driven into the knee-joint from the outer side and were removed 47 hours later. No fresh incision was made and the pus only partially escaped from the wound, which was far back on the outer side. Hence on the twelfth day an incision had to be made into the synovial cavity above and to the outer side of the patella, into which a bundle of fishing gut sutures were inserted. Movement had been begun from the first and was trying, requiring an exercise of the patient's will, and between the movements the joint had to be kept on a splint to prevent it from becoming flexed. In the end extension was complete and there was flexion to less than a right angle, but muscular atrophy was marked and the knee remained puffy.

Cotte on the Macedonian front, out of 21 cases of wounds penetrating the knee-joint, adopted the plan of Willems in 17 of the cases as soon as they came under his care.

*Case* 1 had been injured by a bullet four days before. A large haemarthrosis was evacuated and the incision sutured. The joint was moved by the patient immediately. Much effusion followed, which escaped between the sutures, movements became painful and imperfect, he could not walk until the fifteenth day. When evacuated he had about half flexion.

*Case* 2. Two days after the injury the wound was excised and the bullet lodged in the popliteal space was removed through a separate incision. No sutures were inserted and the joint was moved from the first. On various occasions a large quantity of turbid fluid escaped when the knee was flexed. The wound healed in a month, there was no more effusion, the patient walked well, the joint could be completely extended, flexion was a little limited.

*Case* 3. A shell wound was excised, the joint washed out with ether and sutured, movements were begun at once, serofibrinous fluid escaped between the sutures, wound healed in a month, pain on extreme flexion, flexion somewhat limited. Muscular atrophy, and diminished circumference of 3 cm. Walked well.

*Case* 4. Two days after injury wound excised and synovial membrane stitched to skin, immediate movement, healed in a month. Some hydrarthrosis persisted with a little muscular atrophy. Movements of knee-joint completely regained.

*Case* 5. Eight days after injury wound excised, shell fragment removed from outer condyle, 50 cm. of turbid fibrinous exudation removed. Wound sutured, movement begun at once, healed in a month, no fluid in joint, complete mobility of joint.

*Case* 6. Eight days after fragment of shell removed from knee, wound sutured, moved at once; good movement at end of a month.

*Case* 7. Two days after shell fragment removed, wound excised and synovial membrane stitched to skin, immediate movement, much serofibrinous fluid escaped. Before each movement fibrin blocked the wound but was displaced at the commencement. Patient at first able to walk, then towards the end of the month movement became more and more painful so that the flexion failed each time to empty the joint; four weeks after the first operation the joint was drained and the limb raised to an angle of 45°. A week after the second operation an incision into the lower third of the thigh let out a collection of pus. Seven weeks after the first operation a fourth was required to evacuate pus from the popliteal space. Three months after the wound the patient was evacuated with the joint ankylosed.

*Case* 8. Similar to Case 7. For a week movements could be carried out, then they became more painful and an incision was required above the patella and the limb was elevated, five weeks after the second operation an abscess in the leg was opened, nine weeks after the third operation there was an abscess in the thigh. Then amputation was done, and after a further three months the man was evacuated with the stump healed.

*Case* 9. Two days after being wounded a fragment of shell was removed from the outer condyle, the wound was kept open and movements begun, which became gradually more and more painful, and 14 days after the first operation excision was done; three months later there was firm union.

*Case* 10. Similar to Case 9. Excision at the end of 14 days, firm union in three months.

*Case* 11. Four days after the wound the bullet was removed from the lower end of the femur, the wound excised and sutured, immediate movement, fluid escaped between the sutures, irregular disturbances of temperature, healed in two months with fluid remaining in joint, swelling around the joint, flexion limited, some lateral mobility, thigh 5 cm. less in circumference.

*Case* 12. A shell wound had penetrated the joint, it had been excised and drained, seven days later Cotte removed the drain and movement was begun. This was followed by abundant formation of pus which was not evacuated by the movements, but some could be squeezed out. Three weeks after no movement could be made or tolerated, then excision was done, three months later the wound had healed and the union was becoming firm.

*Case* 13. Similar to the above. After movement pus collected in the popliteal space, excision 14 days later, an abscess in the leg 14 days after the excision. When evacuated the union after excision was becoming firmer.

*Case* 14. Similar to Case 13. Excision after one month, five weeks later a popliteal abscess, union becoming firmer when evacuated.

*Case* 15. Wound excised in an English hospital, eight days later movement begun followed by relapse. Excision three weeks later, two months later an abscess in the outer side of the thigh.

*Case* 16. Fracture of outer edge of patella by shrapnel. Movements at once after excision, free suppuration and necrosis of lower end of femur. Amputation, stump healed in three weeks.

*Case* 17. Similar case. Movements followed by suppuration and necrosis of lower end of femur. Amputation. Death from pneumonia one month after the amputation.

It will be seen from the foregoing accounts that the proposal of Willems to run counter to general experience has not been substantiated.

(*a*) Immediate movement after the excision of a semilunar cartilage is quite unnecessary; nothing is gained, there is immediate risk, and no evidence has been given as to the joint regaining full strength.

(*b*) The complete evacuation of pus from the knee-joint by voluntary flexion is an interesting experiment; but it is clear that it only occurs when the infection is strictly limited to the synovial membrane. The established measure of washing out the joint and closing it, followed by immobilization for 10 days or more, is much safer.

(*c*) Immediate movement after gunshot wounds is emphatically contra-indicated, as Cotte himself acknowledged.

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# TRANSFUSION OF BLOOD IN CIVIL PRACTICE

Before the war there was already a revival of interest in the practice of transfusion of blood, especially in America, and thence sprang the chief impetus which led to the extensive use of transfusion of blood among the wounded. A retrospect will demonstrate a great number of debatable issues, and there is much doubt as to the application of transfusion of blood to civil practice.

**Methods.** The direct method of transfusion underwent a marked improvement in preventing the mechanical formation of a clot owing to the experiments of Carrel and Crile. In 1902 Carrel first described the method of uniting blood-vessels by turning the roughened cut edges outwards so that, the endothelial surfaces being approximated, there was then no opportunity for the formation of a thrombus at the line of union.

In 1907 Crile described 225 experiments on animals and 32 clinical cases in which he had joined the radial artery of the donor to the median basilic vein of the recipient. The free end of the artery was turned back like a cuff. At first he employed a tube on the principle of Murphy's button, except that the margins were turned out.

In 1910 Pool and McClure dispensed with this aid and adopted Carrel's end to end suture method. This procedure has been used for the wounded, but it is obviously a difficult matter to keep the arms of the donor and recipient fixed close alongside one another, then so to divide and raise the radial artery and to join it with the basilic vein that neither stretching nor exposure will cause the arrest of the flow of blood.

The interposition of cannulae joined by a rubber tube renders direct transfusion easier, the cannulae and rubber tube being first lined with paraffin. This modification was used by Fullerton, Dreyer, and Bazett in 1917. The rubber tubing joining the arterial with the venous cannula was so transparently thin that pulsations could be felt, and thus it could be ensured that the blood was flowing. The special difficulty is the raising of the radial artery and the insertion of the cannula, also the prevention of stretching and of cooling after it has been inserted, which is necessary so that the artery may not become thrombosed above the cannula. Moreover, it is difficult to form an approximate estimate as to the amount of blood which has passed from the donor into the recipient, and the general signs of loss of blood by the donor and of a gain of blood by the recipient are very variable. Skill and experience are so necessary that the direct transfusion of arterial blood cannot come into general use. Direct transfusion from vein to vein may appear more easy, the donor's cannula being inserted towards his hand. King suggested that a venesection band on the arm above would create pressure sufficient to drive the blood into the recipient's vein. His communication, however, did not say that he had tried the procedure.

Charles and Sladden, in the three weeks of fighting preceding the armistice, viz. from Sept. 27 to Oct. 15, 1918, found among 2,823 wounded that 234 needed special treatment to resuscitate them—74 of the 234 by intravenous injections, either by transfusion of blood or by infusion of the gum arabic solution of Bayliss, or by both; in a few to counter gas gangrene an injection of sodium bicarbonate and glucose was used.

Transfusion of blood proved the only reliable method in cases suffering from severe haemorrhage; in the worst cases it was required without delay before any operative measures were undertaken; in the less severe cases the transfusion was done after the operative procedures. The whole blood was passed from the vein of the donor to that of the recipient through paraffined cannulae and junction tubing. A brisk stream was ensured by a blood-pressure armlet on the upper part of the arm adjusted to about 50 mm. of pressure. The donors gave up to 500 c.c. without trouble, but began to be distinctly disturbed by further loss.

Oehlecker, of Hamburg, connected the basilic veins of the donor and recipient by inserting a cannula into each, that in the donor being directed towards the periphery and that in the recipient towards the heart. In the middle of the rubber tubing connecting the cannulae he inserted a 3-way stopcock, an idea first originating with Blundell in 1818, and revived by Unger in 1914. A syringe holding 100 c.c. was fashioned so as to connect with the third way of the stopcock. This syringe, before being connected, was made to draw in 10 c.c. of sodium citrate solution, and the cannulae and rubber tubing were filled with the same solution. Then the syringe was connected and the stopcock was made to open a way between it and the donor's vein. 50 c.c. of blood were sucked into the syringe, the stopcock turned, the blood and citrate solution was then driven from the syringe into the recipient's vein. A second syringe already containing 10 c.c. of citrate being ready, it could be quickly exchanged with the first, and so the injection again of 50 c.c. of blood mixed with citrate repeated. The method, in addition to providing against clotting, allows of the measurement of the amount of blood injected. The transfusion completed, one litre of salt solution can be slowly injected into the vein of the donor. That venous blood was transfused and not arterial, did not seem to matter. Oehlecker had followed this plan in 47 cases, generally injecting about 400 c.c., but in some up to 800 or 1,000 c.c. without disturbance.

In 1913 Lindemann described a simple syringe method for the injection of small quantities of blood. For this cannulae, short pieces of tubing, and 4–6 20 c.c. syringes with needles are wanted. All were lubricated with paraffin. A cannula, a fine one for a child, was inserted into the basilic or other vein directed towards the head, and having at its outer end a short piece of rubber tubing closed by a clamp. Another cannula was inserted into the vein of the donor directed towards the periphery, also with a piece of rubber tubing attached closed by a clamp, and a venesection band was placed round the arm. Blood was drawn through the rubber tube and cannula of the donor and quickly injected into the recipient. Then the syringe was handed to an assistant to wash out with salt solution and again lubricated with paraffin, whilst a second paraffined syringe was used to inject another amount of blood. Small quantities of unaltered blood can thus be transfused. This was the method used by L. Bruce Robertson in 1916 and 1917.

In order to carry it out in a large way Kimpton and Brown used a glass cylinder, lined with paraffin, into which the quantity of blood to be transfused was let by venesection. But subsequently it was found better to let the blood into a solution of sodium citrate. The percentage of sodium citrate had necessarily to be less than that which would haemolyse the recipient's blood. The citrate method was started in 1915 by Agote, of Buenos Ayres, who citrated the blood to 2·5 pro mille, Lewisohn to 2·0 pro mille, Weil to 5·0 pro mille.

The transfusion of citrated blood was widely employed in France and the technique improved. In 1918 Oswald H. Robertson described an adaptation of the aspirating bottle connected with the donor's and recipient's veins by large needles with which the veins could be punctured in place of having to incise for a cannula. Blood could be aspirated from the donor into the sodium citrate in the bottle, and then driven from the bottle into the vein of the recipient. An isotonic solution of sodium citrate, i.e. 3·8 per cent., was made and 160 c.c. placed in the bottle, which was enough for 500–800 c.c. of blood; if 500 c.c. were let in, then the resulting mixture contained 9·0 pro mille of citrate; if 800 c.c. it contained 6·0 pro mille of citrate.

Oswald H. Robertson made a further proposal that blood might be preserved by adding dextrose. In preparation to receive 500 c.c. of blood, 350 c.c. of 3·8 per cent. of sodium citrate and 850 c.c. of 5·4 per cent. (i.e. isotonic) dextrose solution were required. This mixture could then be preserved in an ice chamber until wanted.

Charles and Sladden, besides the direct vein to vein transfusion above mentioned, used the citrate method as follows: blood was drawn from the donor into a measure containing a 5 per cent. solution of sodium citrate until there was 10 per cent. of blood to 1 per cent. of the citrate (500 c.c. to 60 c.c., 1 pint to 2 oz.). The solution of sodium citrate was kept ready in the autoclave at 40° C. and was well stirred and shaken as the blood flowed in. The citrated blood was kept warm at 40° C. and then run into the recipient's vein through a funnel tube and needle as in the case of an intravenous saline infusion.

**Blood tests.** One of the failures which had attended transfusion of blood in former days was found to be due to the agglutination and haemolysis on the part of certain recipients of the red blood corpuscles of some donors. The blood of dogs does not vary as does human blood, hence accidents occurred in men which had not been met with in experimental transfusions.

In 1901 Landsteiner divided normal human blood into 3 groups; in 1907 Jansky described 4 groups, as also did Moss in 1910. The group which Jansky had termed Group I, the most frequently met with, Moss called Group IV, and the Group IV of Jansky is the Group I of Moss. Group II and Group III are the same in both classifications.

The important point is that the patient's serum must not agglutinate, or further still haemolyse, the red blood corpuscles of the donor; the donor's serum may agglutinate and haemolyse the patient's red corpuscles without harm. Donors belonging to the Group IV of Moss are therefore to be selected because their blood corpuscles are not agglutinated by the sera of any of the groups. The Group I of Moss is the preferable recipient because the sera of that group contains no agglutinin which can agglutinate the red corpuscles of any of the other groups. Conversely Group IV are bad recipients, except from donors belonging to their own group, because their sera agglutinate the red blood corpuscles of the other three groups. And Group I are bad donors because their cells are agglutinated, except by the sera of their own group.

Some have observed less danger from agglutination in the case of citrated blood, and Gordon Ward suggested that only the plasma of the citrated blood should be infused. But he assumed that the red blood corpuscles of the donor are without value, which begs the whole question.

Oswald Robertson and Bock estimated the amount of blood lost by the loss of haemoglobin, using the vital red colour test. A reduction of haemoglobin to 25 per cent. indicates the necessity for the transfusion of blood. The loss of blood volume was estimated by the blood-pressure armlet, the diminution in volume being parallel with the diminution in blood-pressure.

What happens to the transfused blood is obscure. Miss Ashby detailed the different means by which it had been tried to find out how long the red blood corpuscles of the donor survived in the recipient's blood. When the donor belongs to Group IV his corpuscles continue in the blood of the recipient inagglutinable. The red blood corpuscles of a donor belonging to Groups I, II, and III can be clumped by adding agglutinating serum. So by counting day by day the diminishing number of inagglutinable corpuscles in the recipient's blood until all have disappeared, it was found that this takes about 30 days.

Huck found that, following the transfusion of 500 c.c. of blood, the recipient's blood might show a temporary increase from e. g. 880,000 to 1,488,000; following transfusion of 650 c.c., 480,000 to 1,300,000; but this increase rapidly fell off, so that at the end of 24 hours the recipient's blood showed approximately the same number of red corpuscles as before. In some there was indeed an immediate diminution, and if any permanent increase followed transfusion it was only small in amount. Transfusion causes a definite rise of haemoglobin, but there may be a fall after 24 hours. There was always some increase in the polymorphonuclear leucocytes, but definite new nucleated red cells from the marrow were not met with. As to the real effect of transfusion no conclusion could be reached, except that there appeared to be a redistribution of blood in the body. As to the definite quantities of blood introduced, no exact parallel mechanical effect could be demonstrated. Drinker and Brittingham noted that even when all care was taken the transfusion of citrated blood apparently sets up more haemolysis than direct transfusion, because shivering or indeed rigors and elevations of temperature to 101° or 101° F. occur in 40–60 per cent., although these disturbances soon subside.

**Shock.** One of the general meanings attached to the word shock is that of a sudden and violent physical or mental impression. It is a word which has been used during the war with the greatest freedom, both in English and in foreign languages. If anything, there is greater confusion than ever over the word, and this has rendered more difficult still the consideration of the conditions to which this name is given.

Before the war the general use of saline infusion gave prominence to the idea of restoring the fluid part of the blood in the arteries, i.e. when the infusion resuscitated the patient. This left in doubt, at any rate, the cases in which the infusion failed to resuscitate, or in which the resuscitation was only temporary. According to Bayliss, the failure of saline infusion might be explained by the rapid escape from the blood-vessels of the saline fluid infused. Hence Bayliss added gum arabic, and the wide adoption of his method has confirmed to some extent his theory. An infusion of salt solution containing 6 per cent. of gum arabic does maintain the raised blood-pressure longer than salt solution without gum. But it is only a question of degree. The use of the solution continued to be empirical.

According to Oswald Robertson and Bock, the volume of blood lost by wounded soldiers is more rapidly restored by rectal saline infusion and by forcing upon the patient the taking of fluids by the mouth. Not only so, but new red blood cells from the marrow appear more freely when the volume of blood is increased in this way. The rectal saline infusion and forcing fluids by the mouth stimulate the bone marrow more than does transfusion of blood or the gum and saline intravenous infusion. As mentioned above, when haemoglobin is reduced below 25 per cent., transfusion of blood is indicated; when above, fluids by the mouth and rectal infusions are best, along with an intravenous gum saline infusion as a temporary expedient in case of urgency.

The search for the 'lost blood', or the fluid of the blood lost from the blood-vessels, when no external or internal haemorrhage has occurred, has as yet failed. The old notion that blood collected in the large abdominal veins and that the smaller arteries were dilated had been for a long while contested by J. D. Malcolm. It is now agreed that his contention is correct, that the arterioles are contracted rather than dilated. This reversal of general opinion thus opposes the use of vasoconstrictor drugs in the treatment of shock.

Experiments as to the effect of toxic agents of all kinds tended, according to Bayliss, to the conclusion that the capillaries were caused to dilate. This occurred especially in what was distinguished as 'wound shock'.

According to Dale and Laidlaw, a toxin derived from tissue destruction, which they named histamine, set up changes in the capillaries similar to that taking place at the commencement of inflammation. The poison caused a loss of capillary tone, and as a result there was an escape from the capillaries of plasma. When there had been no external or internal haemorrhage, the number of red corpuscles in a given quantity of blood was increased.

In the discussion opened by Bayliss, Cuthbert Wallace summed up his very large experience. Besides shock from loss of blood, loss of heat, and toxaemia, he recognized shock in men without external wounds, and with very slight internal injuries discoverable by post-mortem examination. All that could be made out was a concentration of blood which, if marked, caused death in spite of all treatment. This would appear to be the pure or nervous shock of many writers. In such a case rest and warmth might be followed by high blood-pressure, and yet operative interference usually caused fatal collapse. Such cases, when the pulse was slow, were nearly always fatal, the condition of the patient resembling that induced by injury to the upper part of the spinal cord. There was no clinical evidence as to 'lost blood', no engorgement of intestines or of superficial veins, no oedema of tissues, subcutaneous or deep. Rest and warmth were the first requisites, and provision had to be made for warming the blankets covering the men whilst on the stretchers, the delay before they could be put to bed being of critical importance. The chief object was to obtain dilution of the blood, of which a diminution in haemoglobin was a good sign.

Erlanger and Gasser, as a result of the above blood concentration, found that the red blood corpuscles tended to clump in the venules and capillaries, which became choked and dilated. This, in addition to capillary dilatation, followed by exudation of plasma, caused the capillary circulation to be delayed, and tissue respiration and nutrition suffered. Hence they argued in favour of adding dextrose to the solution on the idea that it serves for tissue nutrition.

Two recent communications may be quoted to show how uncertain remains the whole question of shock.

No theory has received wider acceptance than that of acidosis, and many pathological states have been attributed to it besides shock. According to Benjamin Moore, there is no such thing as enhanced acidity of the blood warranting the use of the term acidosis, but rather an increase of alkalinity of the blood in shock. Attempts to take in more oxygen causes an excessive discharge from the blood of carbonic acid. This may be the result of hyperpnoea as in mountain climbing, but in the case of shock there need be no excess of breathing, indeed less air may be inhaled. But owing to the impaired rate of circulation whilst respiration goes on at its usual rate, there is a disturbance of the normal equilibrium in working of the circulatory and respiratory systems. There is a diminished production of carbonic acid, but no corresponding diminution in the amount of carbonic acid which escapes, so that the blood is rendered more alkaline. Thus Moore would substitute 'alkalosis' for 'acidosis', and he condemns the administration of bicarbonate of soda.

Whilst the consideration of recent communications on shock do not afford help towards the question of the indications for the transfusion of blood in disease, it cannot be concluded that the gum saline infusion is an advance over simple saline infusions. Thus Rogers found that cholera patients, such as might be expected to receive relief from saline infusions, were made worse by gum solutions, which excited dyspnoea and cyanosis. Rogers explains this as due to the gum solution causing the deadly cholera toxins to be retained in the blood.

**Transfusion of blood in disease.** In 1915 Oltenberg and Libman, using Lindemann's syringe method, along with Unger's two-way stopcock, had made 212 transfusions of blood into 189 patients at the New York Mount Sinai Hospital. They claimed that the transfusion had saved life in 42, i. e. 22 per cent. of the 189 patients. 29 of the 42 recovered sufficiently to be discharged; 13 had their life prolonged. Among these were 6 suffering from pernicious anaemia, 1 from chronic leukaemia, 2 from cancer, 1 from the haemorrhagic diathesis, and 1 from splenomegaly and anaemia. Of the 29 who recovered, 9 were suffering from gastro-duodenal haemorrhage, 3 from hereditary haemophilia, 3 from ectopic pregnancy, 7 from the haemorrhagic diathesis, and 1 from a bleeding uterine fibroid; 1 had haemorrhage after an operation on a kidney, 1 had haemorrhage in the course of typhoid fever, and 1 had been poisoned by illuminating gas and morphia.

They also claimed that a further 43 cases were much benefited, including cases of dysentery with anaemia and septic osteomyelitis. Death occurred in 3 cases of transfusion owing to incompatible blood.

In a subsequent communication in 1917 these authors said they had adopted the citrated blood method, the proportion of sodium citrate in the transfused blood being 3 pro mille. As this strength did not lengthen the coagulation time, it could be used for haemophilia.

They found that in gastro-duodenal haemorrhages transfusion seemed to check the bleeding when administered whilst it was going on. In typhoid fever they transfused blood on the first appearance of blood in the stools. In the case of ectopic gestation, they had transfused the blood from the peritoneal cavity back into the patient's veins. In haemophilia the transfusions had to be repeated. In pernicious anaemia the patient might improve. The chief contra-indication to transfusion was congestion of the lungs and pneumonia.

The whole blood injection for melaena neonatorum was facilitated by the fact that the mother's blood was compatible with that of the infant. It was employed successfully by R. Hutchison.

In infants in whom no large vein could be found the blood could be introduced into the longitudinal sinus. The details of this procedure were described by Tarr. The infant being wrapped up and held at the end of a table, the posterior angle of the anterior fontanelle was located and the scalp painted with iodine. A hypodermic needle of 23–18 gauge was then taken and thrust downwards and slightly backwards until the resistance was felt to have been penetrated and blood appeared through the needle. The mother's blood might be transfused straight away, or a little blood can be first withdrawn for testing. Tarr used the sinus also when making other infusions such as of dextrose for diarrhoea.

Pemberton reported 1,036 transfusions made in the Mayo Clinic between Jan. 1, 1915, and Jan. 1, 1918; 5 by the Kimpton paraffin-lined cylinder, 30 by a modified syringe method, and 1,001 by the citrate method.

In 185 cases of pernicious anaemia, 65·7 transfusions of blood were made with temporary benefit, except in extreme cases. Also 10 out of 20 cases of leukaemia were temporarily improved. Cases of secondary anaemia were mostly transfused as a preliminary to operating and were all considered to have received benefit. 25 cases of acute toxic and septic infections, not otherwise relieved, had 34 transfusions, and the results suggested further trials. To penetrate the veins a hollow needle (gauge 11) was used, the vein being fixed by transfixing it with a fine sewing needle and passing the hollow needle under the sewing needle. The proportion of sodium citrate was 2·4 pro mille, and the citrated blood was run in slowly through a funnel and tube. The general dose was 500–750 c.c. of blood, repeated after 5–7 days.

Lewisohn made 200 transfusions on 150 cases in 2 years. 9 infants with melaena neonatorum would all have died; a single transfusion saved 6. Of 3 children with haemophilia, in 2 bleeding was arrested by one transfusion, and in the third by four transfusions.

One man, aged 32, suffering from haemophilia, in which transfusion was successful, had lost 3 brothers, also 6 cousins, children of his mother's two sisters, all after ritual circumcision. 24 cases of pernicious anaemia had 39 transfusions; 7 improved, 4 did not improve, and the rest died.

Leyton had made 100 transfusions in various forms of anaemia.

Oehlecker, adopting the direct vein to vein method noted above, had employed transfusion in 17 cases of pernicious anaemia, at ages 34–58, in 9 men and 8 women.

*Case* 1.—Transfusion was stopped after 100 c.c. owing to repeated vomiting. No evidence that death was hastened.

*Case* 2.—Died 6 days after transfusion from acute otitis media and fibrinous pneumonia of right lower lobe.

*Case* 3.—Died 5 days after, the post-mortem showing a plastic type of pernicious anaemia.

*Cases* 4, 5, *and* 6 had each less than 1,000,000 red blood corpuscles. Each received 800–1,000 c.c. of blood—there was temporary improvement followed by relapse after 6–8 months. A second transfusion did not benefit. One woman had three transfusions from each of her 3 sons. All of these 3 cases died.

*Cases* 7 *and* 8 had marked gastro-intestinal symptoms. They were much relieved by the transfusion, and the improvement continued for 7 months.

*Case* 9 improved for 6 months, then the blood-count fell.

*Case* 10 had 600 c.c. from a son, followed by marked improvement for 9 months, then there was a slight relapse. A second transfusion of 750 c.c. from the son was followed by another improvement.

*Case* 11, in bad condition, had 700 c.c. of blood from his wife; the improvement lasted for 9 months. Then another 1,000 c.c. from his wife made his blood almost normal for a year. A third 1,000 c.c. from his wife caused an improvement for 5 months. A fourth transfusion at the wife's insistence was followed by death.

*Cases* 12–16 received 800–900 c c. and improved for 6, 10, 14, 15, and 20 months respectively. One patient had a second transfusion after 7 weeks to make more certain.

*Case* 17 improved so after transfusion that after 7 weeks the spleen was removed. There was a relapse after 6 months, when two transfusions were made.

Ross and Hund tried the effect of transfusion of citrated blood on cases of pneumonia complicating the severe 'influenza' epidemic in the United States. 285 cases were admitted to an emergency hospital, and among them 28 cases, including cases almost moribund, were transfused, the result being compared with the fate of 21 cases simultaneously treated, except that transfusion was not done. Of the 28, 6 died, i. e. 22·4 per cent., and 22 recovered; of the 21 not transfused 9 died, i. e. 42·7 per cent., and 12 recovered. On the 4th day after transfusion the number of white blood corpuscles was more than double the number before transfusion.

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W. G. S.

## SEROUS SPINAL MENINGITIS

Under various names—'meningitis spinalis serosa,' 'arachnitis adhaesiva circumscripta,' 'arachnoïdite cloisonnée,' and 'chronic spinal meningitis'—there have appeared during the last twenty years accounts of a condition clinically resembling the symptom-complex of spinal tumour and associated with the presence of adhesions between the spinal theca and the arachnoid, with damming up under pressure and even encystment of the cerebrospinal fluid, which have resulted in the production of medullary compression and paraplegia.

The earliest description is that of Schlesinger (1898), who described a localized hydrops of the spinal meninges, which produced a picture of compression of the cord.

In 1903 Spiller, Musser, and Martin described what later records prove to have been a typical case in a woman who came under observation for severe pain radiating down the anterior aspect of the left thigh. Though constant, this showed periodical intense exacerbations during which, although not paralysed, she was unable to walk on account of the pain produced. Examination revealed no objective motor or sensory changes, but there were knee-clonus, increased ankle-jerks, doubtful plantar responses, and slight scoliosis. Under prolonged observation some weakness of the left thigh muscles developed, the knee-jerks disappeared, and the subjective symptoms increased in intensity. On the diagnosis of spinal tumour, the upper three lumbar vertebral arches were removed. On incision of the dura a transparent cyst was seen to overlie the cord of 1 in. by $\frac{1}{2}$ in. in dimensions. On puncturing this cerebrospinal fluid gushed forth from the theca above under great pressure. No other abnormality was seen. Operation was followed by marked, if incomplete, recovery.

The clinical features of the case appear to have been the presence of pain of multiradicular distribution in a limb, with minimal objective signs of either root or cord defect.

In 1907 F. Krause reported that in a series of 23 laminectomies undertaken for the removal of spinal tumours, a condition of localized adhesion of arachnoid to theca with damming up of cerebrospinal fluid was discovered six times. The patients were all adults, and no definite aetiology was established. Trauma seemed unimportant as a factor. In two cases tuberculous disease, by narrowing the spinal canal, had led to a damming up of cerebrospinal fluid above the constriction. The clinical picture, though closely resembling that of spinal tumour, showed certain features now known to be typical of the condition. The history was of progressive paraplegia predominant on one or other side and associated with pain spread over several segmental cutaneous areas, hyperaesthesia, and paraesthesia.

In 1909, under the title 'chronic spinal meningitis', Horsley described a similar condition and first pointed out the clinical features by which a differential diagnosis from spinal tumour might be reached. He considered the condition more common than spinal tumour. As to aetiology, trauma was not important, and Horsley inclined to the belief that syphilis played a part in the production of the meningitis which led to the formation of adhesions between dura, arachnoid, and cord. He was influenced in this by the prompt relief after decompression and irrigation with mercury. But such uniform good results have followed simple freeing of the cord and re-establishment of the circulation of cerebrospinal fluid that it must be considered doubtful whether a momentary flushing with perchloride solution takes any significant part in effecting recovery.

The clinical picture described by him as characteristic includes the presence of root pains and hyperaesthesia over the area supplied by several posterior roots. These phenomena are not uniradicular as in spinal tumour. The symptoms are also distinctly, though not entirely, unilateral. The motor symptoms are those of progressive spastic paraplegia. On the sensory side subjective symptoms predominate over objective loss, which is commonly incomplete and never dissociated. He did not observe trophic or vasomotor symptoms in any of his cases. The lesion was generally mid-dorsal in level, and the condition found at operation was thickening of the arachnoid and matting of roots by strands of arachnoid tying down both cord and roots. The theca on exposure was distended and non-pulsatile. The circulation of cerebrospinal fluid was definitely impeded by this condition and a stagnation resulted. In an unoperated fatal case the cord was found shrunken and sclerosed at the level affected.

In 1914 Bouché described a case of 'compression médullaire par arachnoïdite cloisonnée', which corresponds in some respects to previously reported cases. There was no history of trauma and no definite aetiology was established. A paraplegia progressing to profound weakness of both lower limbs developed in a man of 27. Examination revealed sensory loss to all forms of cutaneous sensibility extending from the level of the umbilicus down to and including the sensory territory of the second lumbar posterior root. The posterior and internal aspects of the thighs and the areas supplied by the sacral segments showed intact sensibility. The loss was not complete. Sense of position and appreciation of passive movement were intact in both limbs. The knee-jerks were absent; there was double ankle clonus and extensor plantar responses. The cremasteric and lower abdominal reflexes were abolished. The lower segments of the abdominal muscles were weak. There appears to have been a combination of spastic and flaccid atrophic weakness of the lower limbs. There was also hesitant micturition. The cerebrospinal fluid showed marked increase of albumin.

No mention is made of root pains or of paraesthesiae. Operation on the diagnosis of compression paraplegia at the level of the three lower dorsal segments was performed and the dura at this level exposed. It was normal in appearance, but on incising it cerebrospinal fluid gushed out under great pressure and a transparent arachnoid cyst lay on the dorsal surface of the cord. The contained clear fluid was released by incision. Recovery was remarkably rapid and practically complete.

During the period 1914–19 two notable contributions have been made to the subject. Gerstmann (1915), who gives a review of the subject up to date, described six cases of chronic circumscribed spinal serous meningitis following gunshot wounds in the region of the spine.

The condition found at operation was the loculation in one or more arachnoid cysts of cerebrospinal fluid, producing compression symptoms. He regards the condition as difficult to differentiate from spinal tumour.

Perhaps the most comprehensive and important contribution of all to this as yet incompletely elucidated subject is that of Mauss and Krüger (1918). They describe a series of 23 cases which came to operation, and in which the findings are illustrated by a series of coloured drawings of unusual excellence and convincing appearance. For these alone the paper is worthy of study in the original.

The cases are discussed under the following headings:

**Mode of production of the lesion.** In all the origin was traumatic. In 14 there was direct injury to the spine, 12 from gunshot wound, 2 from violence without wound. Of these in 7 the theca or cord was directly involved.

In the remaining 9 the injury was remote from the spine. Four were wounds of the base of limbs, 2 of the shoulder, while 3 were sagittal wounds through the thorax. In two of the direct injuries to the spine callus formation had led to the narrowing of the spinal canal and constriction of the theca. Apart from obvious damage caused in certain cases by glancing wounds, they conclude that the lesions found at operation, and to be described, were due to several factors, among which they include the immediate shock of the impact of the bullet upon the spine and the contained cord, the commotional ‘reverberation’, if one may so use the word, transmitted to the skeleton in general and to the spine in particular, the effect of momentary distortion or displacement of segments of the spine, atmospheric effects produced by the passage of high-velocity bullets, and the irritative effects of direct injury of roots and meninges.

**The nature of the lesion.** At operation the theca at the level of the lesion was found to be covered by a fine, easily separated membrane consisting of old partially organized clot and recent haemorrhages; the dura itself showed thickenings of inflammatory character.

On incising the theca the characteristic and essential lesion was revealed. Strands of fine translucent membrane arising from the arachnoid passed across the space between dura and cord, fixing the latter, matting the roots, and sometimes dragging the cord laterally. In some instances these processes (‘Verwachsungen’) formed a transverse partition damming up cerebrospinal fluid above their level, or formed loculi filled with fluid.

Very noteworthy was the fact that this condition of adhesion and proliferation of the arachnoid extended higher upon the cord than the level to which clinical signs had indicated, and the authors conclude that the process remains harmless unless it produces compression of the cord ('Strangulationswirkungen'). In most cases these arachnoid processes were easily removable and not firmly attached to dura or cord, but in a few cases they were more firmly bound down; from this it was thought that the intradural process was not inflammatory in the majority of cases, and indeed such limited histological investigations as were carried out showed no evidence of inflammatory process in the strands of arachnoid. In the case of the firmly adherent processes they could not exclude the possibility of inflammatory exudative phenomena playing a part in their production. Whether the term primary serous meningitis is justifiable as applied to this condition they leave an open question.

On incising the dura it was invariably found that cerebrospinal fluid escaped under great pressure, and the arachnoid bellied out through the incision like a cyst until incision allowed the escape of fluid. A remarkable vascularity characterized these new-formed membranous processes, coils of tortuous vessels coursed in their substance. The contained blood of these was almost always purple in colour, suggesting venous obstruction and general interference with the vascular supply of the cord. The freeing of the cord and division and removal of the proliferated material produced at once a visible return to more normal vascular conditions, the distension of the vessels abated, and their contained blood resumed its normal red colour. This membranous adhesion and loculation they regard as the essential lesion. In more severe cases the dura and cord were bound tightly together and the subarachnoid space completely obliterated at the site of the lesion.

**Symptomatology.** Always root symptoms predominated and signs of defective conduction in the cord were sometimes absent and usually minimal.

(1) *Irritative sensory phenomena.* Root pains, paraesthesiae, and hyperaesthesia were prominent symptoms in all cases, and corresponded in extent with the area of objective sensory change. They were radicular in distribution and included the cutaneous territory of several roots, and seem never to have been uniradicular. A uniradicular zone of hyperaesthesia at the upper level of the lesion was never seen. The pain and hyperaesthesia were in many cases intense and rendered the patient helpless, quite apart from any true loss of power.

(2) *Irritative motor phenomena* were not less in evidence. They were also of multiradicular type. Many cases showed a tendency to spontaneous or readily elicited reflex movements within the distribution of certain roots; such reflex movements of the lower limbs were worse at night and were a source of considerable discomfort to the patient. Widespread twitching and fibrillation of muscles within the affected area were also seen. Tonic and intense spasm of certain muscles occurred in some cases. In one instance an intense spasm of the pectoralis major and biceps kept the arm pressed firmly to the side and the elbow fully flexed. In another the upper arm and shoulder musculature were wasted and paralysed, while the supinator longus was in strong and maintained spasm producing flexion at the elbow. They were satisfied that these spasms were irritative in origin and differed fundamentally from the spasticity of pyramidal lesions. They were probably due to posterior root irritation and were reflex in origin. They were extremely painful, and for this reason passive movement was impossible.

(3) *Root defect symptoms* were also present and predominated over cord defect symptoms. *Sensory* loss was usually unilateral in limb segments and bilateral in trunk segments when they predominated on one side. Sensory loss was not dissociated nor complete, and affected all modes of cutaneous sensibility equally in degree and extent. It was multiradicular.

*Motor* disturbance of the same topography as the sensory defects was common; atrophic paralysis of muscles with corresponding electrical changes in a limb were the usual condition. In the case of trunk muscles atrophic paralysis was not so often or so definitely observed.

(4) *Vasomotor, secretory, and trophic disturbances* over the affected root area were seen and resembled those seen in any peripheral nerve or plexus injury. Local sweating was a striking phenomenon.

(5) *Pure spinal symptoms* were seen in several cases. A Brown-Séquard syndrome was once observed. There were marked spinal symptoms in five cases only—spastic paresis and sensory loss with the corresponding reflex alterations. A definite Babinski response on one or other side is recorded in only nine cases. They express the opinion that when conduction defect in the cord was marked intramedullary damage may have been present.

(6) *Variations in symptoms* formed a characteristic feature of the cases. Outbursts of pain and motor irritative and sympathetic irritative phenomena occurred from time to time. Similarly in cervical lesions, the sudden appearance of bulbar symptoms, dyspnoea, nystagmus, facial palsy, and difficulty in head movements provided an alarming crisis. These phenomena, which were one of the strongest indications for operation, were always permanently abolished by such procedure.

**Diagnosis.** In differentiating these cases from cases of actual cord damage they lay stress on the following features of their cases:

(*a*) Variability of symptoms, (*b*) the isolated occurrence of root and segment symptoms, (*c*) the frequency of irritative phenomena, (*d*) the multiradicular distribution of these symptoms.

Topographical diagnosis is by the ordinary methods of spinal localization. High plexus lesions and extravertebral root lesions may offer some difficulties, especially in the case of sacral roots. They record that certain of their cases without cord symptoms were diagnosed as spinal caries, sciatica, hysteria, and duodenal ulcer. In the last named a laparotomy was actually performed.

Treatment is purely surgical and operation appears to have been followed by rapid relief and recovery. In some instances a marked exacerbation of irritative root symptoms followed operation and persisted for over a week.

The end of operation is the division and removal of the proliferated and adherent arachnoid, freeing of the cord in the theca, and the re-establishment of a free cerebro-spinal circulation.

For details of operative technique and other valuable minutiae the paper should be consulted in the original. The illustrations in themselves merit this.

The observations of Mauss and Krüger, although they may not help to elucidate the aetiology of serous spinal meningitis as recorded previously under peace conditions, indicate how indirect trauma may lead to the development of 'arachnitis adhaesiva circumscripta', and certainly give precision to our clinical conceptions of this pathological condition. The inevitable fatality of prognosis in untreated cases, and the remarkable response to operation, make accurate diagnosis important, and if, as Horsley maintained, it is more common than spinal tumour, the clinician should be familiar with its clinical picture.

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F. M. R. W.

# ABSTRACTS

## SURGERY

**Tenani, O.** Sopra una variante di resezione pilorica. [**A modification of pyloric resection.**] *Policlin.*, Surg. Section, 1919, **26**, 186.

Of the three available courses that can be adopted after excision of the pylorus the method of direct anastomosis has the serious disadvantage that perfect and secure suturing is difficult to effect. The second method, the termino-lateral gastro-duodenostomy of Kocher, necessitates an undue tension on the duodenum and, in cases of extensive resection, it may be impossible to bring the surfaces of stomach and duodenum into contact. The third method, that of complete closure of both the gastric and the duodenal stump after a preliminary gastro-enterostomy, is the one in general use. But here, again, the secure closure of the duodenal stump is difficult to obtain, and healing is apt to be interfered with through stagnation of the biliary and pancreatic secretions, especially if obstruction should arise in the efferent loop. Free drainage of these secretions can, however, be secured by establishing a complementary anastomosis between the afferent and efferent loops, provided that the former loop is made sufficiently long to enable the opening to be effectively placed, that is, not too near the gastro-enterostomy opening.

The modification which Tenani suggests, and which he has successfully used in three cases of excision of the pylorus for carcinoma, is designed to avoid the danger of leakage at the duodenal stump, and to provide for the free passage of the biliary and pancreatic secretions into the efferent gastro-enterostomy loop. The operation is performed in three stages:

1. A posterior transmesocolic gastro-enterostomy.
2. Pylorectomy, with closure of the gastric stump.
3. Mobilization of the duodenum: termino-lateral anastomosis between the cut end of the duodenum and the efferent loop at a short distance from the gastro-enterostomy opening. Thorough mobilization of the duodenum is required in order to carry out this anastomosis. It is necessary to separate the tube entirely from the parietal, that is the duodenorenal, peritoneum, the peritoneum being incised close to the bowel along the whole length of the second part of the duodenum, which is then pushed inwards with the head of the pancreas. The gastro-hepatic omentum is then divided, thus permitting the duodenal stump to be drawn downwards, and the anastomosis is readily carried out. An almost vertical position of the duodenal stump, facilitating the discharge of secretions into the efferent loop, may be obtained by fixing the duodenum to the stomach by means of one or two sutures inserted opposite the bile-papilla, so as to produce a slight bend in the duodenum in that situation.

T. W. P. L.

**Pieri, G.** Ricostruzione del pollice dal moncone della falange basale. [**Reconstruction of the thumb from the stump of the basal phalanx.**] *La Chirurgia degli Organi di Movimento,* 1919, **3**, 325.

One of the most frequent types of mutilation of the hand which occurred during the war was that resulting from the premature explosion of hand grenades. In some cases the radial half of the hand is carried away, in others less severe the mutilation is limited to the first two or three digits. The gravity of the resulting deformity lies mainly in the loss of the thumb: the reconstruction of this should be the chief aim of the surgeon, and its accomplishment is comparatively easy, provided that some portion of the proximal phalanx remains undestroyed.

Where only the base of the phalanx remains probably the best course is to perform a cinematic operation. A flexor-extensor loop is constructed from the tendons inserted into the base of the phalanx, and a tunnel created by means of a plastic operation, after excision of the head of the first metacarpal bone. The author used this method in one case with satisfactory results. Where the remnant of the phalanx includes at least its proximal half, it is better to create a short thumb in which the first metacarpal bone and the remnant of the proximal phalanx play the part of the proximal and terminal phalanges of the normal thumb. This is effected by dividing the soft tissues between the first and second metacarpal bones so as to form a deep gap between these bones, and render the first metacarpal free.

The operation—'phalangizing the metacarpal', as the author expresses it—gives better results as regards the freedom of movement of the first metacarpal bone, if a wide intermetacarpal space is provided. This can be done by removal of the second metacarpal bone, and is justifiable in cases where the index finger has been destroyed. Definite rules for placing the skin incisions are impossible in irregular wounds of this kind; but the large cicatrix which usually adheres to the extremity of the second metacarpal should be removed *en bloc* with that bone. In disarticulating the second metacarpal the adductor fibres of the thumb are removed in order to form the new intermetacarpal space, the remaining muscles of the thenar eminence being carefully preserved. The type of skin-flap to be used for covering the interspace will depend on the extent of healthy skin available. Pieri was able, in one case, to form a single posterior flap, sufficient to cover the whole space and long enough to bring the cicatrix well forward out of the interdigital sulcus. In a second case, two flaps were formed: one with base posterior to cover the radial side of the space, the other with base anterior for the opposite side.

The new thumb created in this way is shorter than normal, or rather it has a more proximal insertion. The disadvantage resulting from this is, however, much diminished by the fact that in almost all these cases the terminal phalanx of the next digit (and sometimes in minor degree of the remaining digits) has a flexor retraction.

The operation restores the function of prehension. The new thumb possesses sufficiently free movements of flexion in both joints and a movement of adduction with internal rotation, due to the preservation of the opponens muscle. It also possesses a limited degree of simple adduction, due apparently to an accessory action of the long flexors and extensors.

T. W. P. L.

**Perrone, G.** e **Tanfani, G.** Contributo alla topografia fascicolare dello sciatico popliteo esterno in un caso di lesione isolata del nervo muscolo cutaneo in prossimità del collo del peroneo. [**Fascicular topography of external popliteal nerve.**] *La Chirurgia degli Organi di Movimento*, 1919, **3**, 332.

The authors have met with a particularly favourable opportunity of studying the fascicular topography of the external popliteal nerve. The patient had received a bullet wound in the leg, by which the musculo-cutaneous nerve was completely severed, while the anterior tibial remained intact. Immediately below the head of the fibula there was an oval cicatrix of the size of an almond: the foot was in a position of adduction and internal rotation, and the muscles at the outer side of the leg were atrophied. There was inability to abduct the foot, and sensation was completely lost in the skin of the dorsum, except in a small area at the root of the great toe. Electrical stimulation of the external popliteal nerve produced contraction of the anterior tibial, extensor communis, and extensor proprius hallucis muscles only. Stimulation of the peronei muscles gave negative results with the faradaic current, and a slow contraction with polar inversion on galvanic excitation. The external popliteal nerve and its anterior tibial branch were normal in appearance: the musculo-cutaneous nerve at a short distance from its origin presented a fusiform enlargement, the electrical stimulation of which induced no muscular contraction.

On stimulating the external popliteal nerve it was found that when the electrode was applied to its antero-internal aspect immediate contraction of the muscles innervated by the anterior tibial nerve followed, while stimulation of the postero-external aspect was without effect.

Previous observers, in investigating the fascicular topography of the external popliteal component of the great sciatic nerve, have found that the fibres corresponding to the anterior tibial nerve lie on the internal aspect of the trunk, those of the musculo-cutaneous on the external aspect. It would thus appear that in its course outwards to the head of the fibula the external popliteal nerve undergoes some rotation on its axis, whereby the two areas shift their position somewhat, becoming respectively antero-internal and postero-external.

T. W. P. L.

**Pieri, G. A.** e **Riquier, G. C.** Contributo alla determinazione della topografia fascicolare del nervo cubitale al braccio. [**Fascicular topography of the ulnar nerve.**] *La Chirurgia degli Organi di Movimento*, 1919, **3**, 336.

The fascicular topography of the ulnar nerve was investigated by the authors in a series of four cases of gunshot wound of the arm by the method of electrical stimulation of the periphery of the nerve.

*Case I.*—Paralytic symptoms predominated in the adductor muscles of the thumb; irritative, in the muscles of the hypothenar eminence and interossei. The flexor carpi ulnaris and deep flexors of the fourth and fifth fingers were scarcely affected. There was slight disturbance of sensation. The ulnar nerve was embedded in fibrous tissue immediately above the internal condyle of the humerus. When dissected out it was found to have a small fibrous swelling on its posterior aspect, while the anterior surface appeared to be normal. Stimulation upon, above, and below the nodule gave no motor reaction; stimulation of the antero-internal surface caused ulnar flexion of the hand and flexion of the inner three fingers; that of the external surface, slight movements of adduction in the second and third fingers. From these facts it was concluded that fibres to the adductors of the thumb traversed the posterior part of the nerve; those to the flexor carpi ulnaris and deep flexors of the fourth and fifth fingers, the antero-internal part, and those to the interossei muscles, probably the external part of the nerve.

*Case II.*—Paralytic symptoms predominated in the interossei muscles, the muscles of the hypothenar eminence, and the adductors of the thumb. The flexor carpi ulnaris and deep flexors of the fourth and fifth fingers were scarcely affected. There was marked and permanent sensory disturbance. In the lower third of the arm the nerve was found to be embedded in cicatricial tissue. On isolating it from this it showed a fusiform swelling about 3 cm. in length, which involved the whole circumference of the nerve except its inner surface. The most prominent part of the swelling corresponded to the external surface of the nerve. Stimulation of the external surface caused feeble adduction of all the fingers; of the inner surface, ulnar flexion of the hand and flexion of the three inner digits. Stimulation of the anterior surface was without effect. It was concluded that the fibres for the flexor carpi ulnaris and deep flexors of the fourth and fifth fingers ran in the inner part of the nerve; those for the small muscles of the hand in the postero-external part, and sensory fibres probably in the anterior part.

*Case III.*—The flexor carpi ulnaris, deep flexors of the fourth and fifth fingers, and adductors of the thumb were paralysed. The muscles of the hypothenar eminence and interossei were affected in less degree. Sensory disturbance was slight. The nerve, in the lower third of the arm, was embedded in cicatricial tissue, to which it adhered closely on its postero-internal aspect, while it was comparatively free on the antero-external aspect. A fibrous swelling marked the site of the adhesions. Stimulation of this swelling produced no motor effects. Stimulation of the external surface caused movements of adduction and also of flexion in the first phalanges of the fingers. Excitation of the anterior surface gave negative results. It was concluded that fibres to the flexor carpi ulnaris and deep flexors of the fourth and fifth fingers occupied the postero-internal part of the nerve; those for the small muscles of the hand, the external part; and those for sensation, the anterior part.

*Case IV.*—The interossei, hypothenar muscles, and adductors of the thumb were paralyzed. The flexor carpi ulnaris and deep flexors of the fourth and fifth fingers were scarcely affected. There was marked sensory disturbance. The lower third of the nerve presented a fusiform swelling about 5 cm. in extent, involving its anterior, external, and posterior aspects. The internal surface was almost rectilinear. Electrical conductivity could be demonstrated at all points in the periphery of the nerve; but, while excitation of the internal surface caused well-marked contraction of the flexor carpi ulnaris, excitation of the postero-external surface caused merely slight adduction of the fingers. From this it appeared that the fibres for the flexor carpi ulnaris occupied the inner part of the nerve; those for the small muscles of the hand, the postero-external portion.

Summing up the results of these observations, it follows that the ulnar nerve in the lower third of the arm contains fibres for the flexor carpi ulnaris and deep flexors of the fourth and fifth fingers towards its internal surface; for the adductors of the thumb towards its posterior surface; for the hypothenar and interossei muscles towards its external surface; and sensory fibres probably towards its anterior surface. T. W. P. L.

**Pieri, G.** Le ferite d'arme da fuoco del midollo e delle meningi. [**Gunshot wounds of the spinal cord.**] *La Chirurgia degli Organi di Movimento*, 1919, **3**, 257.

Pieri describes and analyses 110 cases of gunshot injury of the spine associated with symptoms of lesion of the cord. His main purpose is to define the significance of nervous lesions and symptoms as indications for surgical interference.

He draws a broad distinction between cases of clinically total lesion and cases in which the lesion was clinically partial. The condition found *post mortem* and during operation, in cases where the symptoms pointed to a *total* lesion, were: (1) Complete division of the cord and pia, with diastasis: lesion of the dura. (2) Complete division of the cord, but not of the pia; lesion of the dura. (3) More or less extensive dissolution of the cord and pia: lesion of the dura. (4) Partial division of the cord and pia; lesion of the dura. (5) Complete perforation of the cord and its membranes. (6) Intrapial softening of the cord: pia and dura unaffected. (7) Cord and membranes macroscopically normal.

Group 7 includes 16 per cent. of the cases of clinically total lesion. External traces of the lesion were found in these in the form of slight extravasation beneath the posterior common ligament (in a case examined 24 hours after wounding); slight haemorhachis (on the third day); and delicate filmy adhesions possibly due to the organization of blood-clot (from the 7th to the 77th day). No microscopical examination was made in these cases owing to unavoidable loss of the specimens. But the changes found in similar cases recorded by other observers are stated to consist in an acute degeneration of the cord, with foci of necrosis mainly confined to its periphery, and degeneration of the posterior roots. It is supposed that at the moment of injury a wave of cerebrospinal fluid is started, the direct impact of which causes degeneration of the cord and nerve-roots, while the transmission of the wave along the perivascular spaces induces temporary spasm of the arterioles with resulting necrosis.

Direct anatomical examination of clinically *partial* lesions was made in six cases only and presented no points of special interest: in one case the cord was found macroscopically unaltered, in another a focus of haematomyelia was present.

As clinical evidence of the presence of a *total* lesion Pieri adopts the generally accepted syndrome: complete and symmetrical paralysis of motion and sensation below the level of the lesion, abolition of the tendon reflexes, and retention of urine and faeces, followed sooner or later by incontinence. In these cases the motor paralysis was constantly flaccid, and remained so to the end, except in two instances. In one of these, in which the 1st lumbar segment was injured, the patient died on the 165th day from pyelonephritis and septic infection from bed-sores: for some weeks before death the paralysis became spastic. In the other case, in which the 11th dorsal segment was wounded, hypertonicity of the muscles of the lower limbs appeared after one month, terminating in definite spastic rigidity, without ankle clonus, patellar reflex, or other evidences of a return of normal nervous function. The condition remained unaltered for the subsequent four and a half months during which the patient was under observation.

In clinically total lesions the patellar and Achilles reflexes were constantly absent. In two cases, however, it was observed, in testing the patellar reflex, that contraction of the biceps muscle could be felt in the popliteal space. In the first case the cord was injured at the 11th dorsal segment, and the reflexes were examined sixteen hours after wounding; in the second the 12th dorsal segment was injured. The former patient died on the 14th day; in the second the condition of the reflex remained unaltered for the three and a half months during which the patient remained under observation. The plantar reflex was present in 22 out of 63 cases. It was demonstrated in 6 cases a few hours after wounding, and in other 16 between the 1st and the 12th days. A second examination was made in two of these cases, after the 3rd and 32nd days respectively, and in both the reflex remained unaltered. In character the reflex was almost always bilateral and consisted in feeble flexion of the great toe alone or, more usually, of all the toes. Pieri remarks that, although it is difficult to draw any definite conclusions from these observations, they appear to contradict the generally accepted view that the normal plantar reflex has its centre in the brain. Defensive reflexes were observed in three cases. In the first, examination of the plantar reflex produced, besides flexion of the toes, contraction of the adductors and flexors of the thighs. The symptoms remained unchanged up to the patient's death on the 20th day, when total softening of the 11th dorsal segment was found *post mortem.* In the second case, plantar stimulation produced contraction of the vastus externus muscle. The symptoms were those of a total lesion at the level of the 1st dorsal segment, but at the autopsy the cord was macroscopically unaltered. In the third case, in which symptoms of a total lesion of the 7th dorsal segment were present, plantar stimulation caused flexion of the great toe and contraction of the tensor vaginae femoris muscle. Semi-erection of the penis was observed in many cases of total lesion, and in three an increased degree of erection followed stimulation of the skin of the perineum or penis, the spinal segments involved being respectively the 1st lumbar and 7th and 12th dorsal. The penile reflex was also obtained in two cases of partial lesion involving the 6th and 11th dorsal segments respectively.

The distribution of the anaesthesia was normal in almost all the cases of total lesion. In one case only was the condition anomalous: in this there was hypoaesthesia of the perineum, scrotum, root of the penis, and upper third of the inner surface of the thigh. At the post-mortem examination the 11th dorsal segment was completely severed, except for a few fibres irregularly scattered over the divided surfaces. In all cases the superior limit of anaesthesia was surmounted by a zone of hypoaesthesia corresponding approximately to the area of distribution of the pair of nerves immediately above the lesion: in six cases this zone was surmounted by a zone of hyperaesthesia, which was, in three of them, associated with paraesthesia.

Subjective sensory changes were observed in 15 cases, and consisted in paraesthesiae—such as formication, heat, tension, lancinating pains, and a sense of constriction—which radiated into the arms, trunk, or lower limbs according to the level of the lesion. These symptoms were probably due in the slighter cases to extravasation of blood around the roots of the sensory nerves, but in one case, in which the symptoms were severe, the direct irritation of the cord itself by a fragment of bone appeared to be the cause. Less easy of explanation are certain cases in which the paraesthesiae appeared only after an interval of some days from wounding, and were prolonged indefinitely. In one such case, where death occurred on the 61st day, firm adhesions between cord and dura were found and were the probable cause of the symptoms.

Trophic changes, other than bed-sores, occurred in two cases of apparently complete transverse lesion of the 9th dorsal segment, in the form of oedema of the right lower limb, associated with effusion into the knee-joint. In a third case, with total lesion of the 3rd lumbar segment, there was, from a few hours after wounding onwards for several days, a zone of intense hyperaemia corresponding to the area of distribution of the 11th dorsal root: this area was also hyperaesthetic.

Pieri separates the clinically *partial* lesions of the cord into two classes —bilateral and unilateral; and in each of these he distinguishes cases with persistent symptoms from those in which more or less rapid amelioration occurred. Among the bilateral lesions with persistent symptoms were two cases of particular interest. In these the symptoms during the first four weeks were those of a total lesion, the partial character of the case only appearing in the subsequent course. In both cases probably, and in one certainly, the injury was direct. The other cases in this class appeared to be due to indirect action in the form of severe contusion: they constantly presented a total paraplegia, paralysis of the bladder, and a partial anaesthesia of definite type, the area innervated by the lower sacral roots being least affected, and in some cases the only one remaining intact.

Of the four cases of clinically unilateral lesion with persistent symptoms, two were probably due to direct injury of one half of the cord, since in both cases the bullet had traversed the cervical spine in an anteroposterior direction near the median plane. Dissociated paralysis of sensation was present, indicating probably a haematomyelia.

From a critical examination of fifty-three of his cases, in which the condition of the cord was directly observed, either during the operation or at the post-mortem examination, Pieri draws certain definite conclusions with regard to the indications for surgical interference.

1. The diagnosis of a total lesion contra-indicates operation.

The differential diagnosis between total and partial lesions is usually easy. Some difference of opinion still remains in regard to the tendon reflexes. It is not admitted by all surgeons that these are necessarily abolished, and cases are cited in which the reflexes were retained, notwithstanding the existence of a total lesion. However, in all such cases referred to up to the beginning of the war, the cord was already altered by prolonged compression, and was therefore in a functional condition differing totally from that existing after a sudden section.

It is desirable to guard against making a diagnosis of total lesion too early in the case. This is illustrated in a case already referred to, in which the evidence of a sub-total lesion (slight movements of the toes) did not appear until six weeks after the injury, the unilateral character of the lesion being then verified at the operation. As bearing on the problem of the differential diagnosis in these cases of partial lesion with syndrome of total lesion, the experiments of Sencert, reported at the French Surgical Congress in 1909, may prove to be of value. Sencert found that total section caused rapid degeneration in the muscles innervated from the distal portion of the cord, while compression produced motor or sensory paralysis, with retention of muscular contractility to the faradaic current. This observation is likely to be of more value in cases of fractured spine than in gunshot injuries, in which direct destruction plays a larger part than mere compression.

The contra-indication to intervention in cases of total lesion implies a rejection of the idea of suture of the cord. Three cases have been recorded in which a more or less limited return of function in the distal segment of the cord undoubtedly occurred, while in other cases the results of this operation have been negative. On the two occasions on which Pieri attempted to perform the operation it was found impossible to approximate the stumps of the severed cord.

2. In completely perforating wounds operation is contra-indicated.

The sole object of operating in such cases would be to remove fragments of bone or extravasations of blood causing compression. As regards compression by fragments of bone, Pieri's cases show that in the vast majority of cases (82·5 per cent.), the bone-lesions were such as could produce no compression, while in the remainder the osseous fragments were the direct cause of the lesion of the cord, which was in every case irreparable. In every case, therefore, operation would have been useless. With regard to compression from extravasation of blood, surgeons are at present agreed in regarding lumbar puncture as the more rational mode of treatment, and consider that laminectomy should be reserved for the rare cases of late cicatricial compression of the nerve-roots.

3. Operation is contra-indicated if the projectile has become lodged outside the spinal canal.

Out of 13 cases of this kind the projectile had traversed the laminae, wounded the cord, and become embedded in the vertebral bodies in ten instances; had traversed the vertebral body, wounded the cord, and become lodged between the laminae in one; and had become embedded in the vertebral body without entering the spinal canal in two, producing an indirect lesion of the cord (in one case contusion, in the other haematomyelia). In none of these cases was any advantage to be derived from operation. In the gunshot injuries met with in civil practice it is not uncommon for fracture of the laminae to occur without causing a total and irreparable contusion of the cord; and it is conceivable that in war a similar condition might be produced by a spent projectile, but such cases must be extremely rare.

4. When it has been proved by means of the X-rays that the projectile is partly or wholly within the spinal canal, and the clinical examination points to a partial lesion of the cord (or a lesion of the cauda), operation for removal of the projectile is indicated. These favourable conditions are met with somewhat rarely; they were present in seven cases only of Pieri's series of 110 gunshot injuries of the cord. T. W. P. L.

**Mende, P.** Künstlich erzeugte Erkrankungen während des Krieges. [**Malingering in Russia.**] *München. med. Wchnschr.*, 1919, **66**, 94.

Mende had seen in the course of 13 months at Dorpat 800, and during another 14 months 400, instances of what he regarded as self-inflicted wounds by Russian soldiers. The commonest were swellings produced by the injection of liquid paraffin or paraffin mixed with vaseline, which produced fibrous swellings varying in size from a hazel-nut to a child's head. They were most commonly placed over the knee or ankle, but also on other parts, even on the face, penis, or scrotum. The swellings were always in the skin and subcutaneous tissue; none had involved the deep fascia or muscles. The swellings, whilst fixed to the skin, were always movable on the deep structures. The injection caused a swelling, often painful, of the lymphatic glands corresponding to the area affected. They became painless and then subsided in the course of a year. According to position they impaired use, and this was especially the case when the hand or finger was affected. The swelling was generally attributed to the kick of a horse, or to an injury on the farm before the war, or to being hit by a stone; less often it was stated to have been caused by a fall off a ladder or waggon. Besides various discrepancies between the story of the accident and the swelling, the injections had been detected in hospital, and the paraffin and the syringe found.

In spite of the lack of asepsis, suppuration rarely happened. In some instances ulceration occurred in the overlying skin. Hot fomentations and baths had no effect; excision was the only way to get rid of these artifacts, to which was the objection that the scars then became the occasion for functional disturbances.

Ulcerations were artificially produced by caustics, generally by soapstone or vinegar, less often by sulphuric or nitric acid. Also benzine was smeared on the leg and then ignited. Nails or copper coins were made red hot and applied, by which dry black eschars were caused which might extend to underlying bone when near the surface. Such ulcerations might be detected by being situated in uncommon places, on the neck, forearm, thigh, patella, popliteal space; they were sharply defined, circular as if stamped, or rectangular when produced by a blistering cantharides plaster, or by being situated over superficial bone and setting up necroses, also by being multiple, as many as 30–80 on the same patient.

Artificial oedema of a limb was produced, not only by a narrow band, but also by such a broad constriction as a handkerchief which left no mark. To expose such men the arm was fixed in an angular splint reaching to the shoulder, and the whole bandaged to the thorax. On the lower limb a long outside splint was fixed, extending from above the hip to a hand-breadth below the sole of the foot, so as to render walking impossible. Then within 24 hours all the oedema would disappear.

Artificial abscesses were produced by injection, generally by injecting materials other than those noted above, e. g. turpentine, petroleum, eau de Cologne, well-water, milk, saliva. These abscesses were often indicated by the special odour of the pus. Streptococci and staphylococci were commonly found. Leptothrix and spirochaetes were not found.

15 men had injected benzine, all subcutaneously except one, into the muscles. There followed a markedly acute inflammatory oedema with a widespread erythema, differing from erysipelas in the absence of a well-defined margin. In all the cases there were noticeable the marks of the injections. At these spots there formed in the first day or two hard nodules the size of pin's heads which enlarged within a few days to be 1–2 cm. in diameter, and became vesicles filled with turbid fluid. Underneath there developed necrosis of the skin and subcutaneous tissues. Generally this necrosis did not spread much beyond the margins of the vesicles, but in 4 cases there was extensive sloughing with profuse suppuration. In one case there were no vesicles nor necrosis, but after the oedema had subsided and the temperature fallen, there was deep fluctuation. A syringe withdrew 10 c.c. of thick fluid blood smelling of benzine. This swelling disappeared within a week under a firm bandage.

The temperature in these benzine injections reached 40·2° C., but within a day or two returned to normal and remained so. It was difficult to find out, but apparently a few cubic centimetres of benzine had been injected 3 or 4 days before the men were first seen. From these observations it would appear that benzine injected under the skin sets up necrosis; if into the muscles, a collection of fluid blood.

A series of cases of necrosis of at least half the scrotum, preceded by marked oedema, were attributed also to benzine injections for lack of more certain evidence.

In the second half of 1916 and the beginning of 1917 so many cases of hernia and rectal prolapse were admitted to the Dorpat hospital as to raise the question of artificial production. Of 1,524 patients admitted during that period, 97 were cases of hernia, 86 being inguinal, and 43 of prolapse of the rectum. The cases were far in excess of what had been the average in the hospital before. For among the same number of patients previously there had been only 6 cases of inguinal hernia and 2 of prolapse of the rectum. The method of production was by taking a small bag of dried peas, dipping them in hot water, and at once pushing the bag up the rectum. When the peas had swollen up, the bag was pulled out of the rectum, bringing down mucous membrane. This process was repeated until the prolapse was established, as well as a hernia.

An acute inflammation of the eyelids, often with severe conjunctivitis, was produced by frequently rubbing the eyelids with urine; the inflammation was also produced by inserting a foreign body under the upper lids, for instance, a gramophone pointer. In order to imitate trachoma, the conjunctiva of the lower lid was rubbed with nitrate of silver, producing a white, deeply adherent slough, which persisted and was attended by much redness and swelling around.

There were a huge number of instances of perforation of the membrana tympani, with or without suppuration. But it was impossible to fix on the cases artificially produced. Fresh superficial injuries were noted in the deep part of the external auditory meatus, but none actually of the membrana. It was common to find, besides wax, wax mixed with wool or tow. Suppuration was frequently produced by injecting urine or croton oil into the exterior auditory meatus. There resulted more or less obstinate eczema of the external auditory meatus, and of the auricle and neighbourhood. Urine could be detected by the odour, croton oil by the severity of the dermatitis. But when ear trouble no longer gave relief from service, they were seen much less often.

The artificial production of lung, heart, kidney, gastric and liver troubles was detected with much more difficulty. Expectorations of blood, not containing lung débris, and with the absence of signs on percussion and auscultation, might be suspected to have come from the mouth or nose. Actual inflammation of the lungs was produced by inhaling chlorine gas produced by adding an acid to bleaching powder. The foregoing material, as well as tobacco mixed with Turkish pepper, had frequently to be taken from hospital patients. From such materials was produced a chronic dry bronchitis, also transient emphysema, and occasionally acute febrile bronchitis, very rarely pneumonia, but in one case this last ended fatally. The patient had been sent into the hospital to have his sight tested, and was admitted with a temperature of 40·2° C., stating that he had had fever and cough for two months. He looked very ill and spoke only with trouble and unwillingly; he developed severe dyspnoea, marked cyanosis of the face, hands, and feet, a severe cough with frothy expectoration, not blood-stained. There was dullness over all the right lung, with abundant moist râles and bronchial breathing. Signs of pulmonary oedema increased, and he died in 48 hours. The post-mortem agreed with the signs exhibited during life. Actual details of the artificial production in the above case were not given.

A high degree of tachycardia was produced by smoking tea, or by taking excess of caffeine or antipyrin, which could be identified in the urine.

True nephritis was frequently produced by taking potassium chlorate. But blood in the urine was often due to injuring the urethra with a pointed instrument, for several patients were caught at it.

The appearance of diabetes insipidus was attempted by excessive drinking so as to produce as much as 5·6 litres of urine a day with a specific gravity varying from 1001 to 1008. Under observation the urine at once fell off to 1·5 to 2 litres.

There were five cases in which an artificial jaundice was produced by picric acid poisoning. One case died, and there was also a death from the same cause in another hospital in Dorpat. The picric acid poisoning caused headache, bad appetite, malaria, scanty stools, and pain in the region of the liver. The skin and exposed mucous membranes were tinged yellow as in natural jaundice. There were no nerve, temperature, pulse, heart, or lung disturbances. There was no evident enlargement of the liver, nor of distension of the gall-bladder. The faeces were normal in colour and smell; the dark red urine contained no albumen nor bile pigments, but a plain reaction of picric acid persisted for a long while. A good test was to place an undyed strand of silk in the urine for five minutes, when it was tinged yellow, not removed by long washing. A cotton thread yielded the colour when washed. Another test was to render the urine acid with hydrochloric acid. Then the colour could be extracted with ether, sodium hydrate then decolorized the ethereal extract and turned red. Purgatives increased the reaction in the urine, which by special tests was detected as long as 25 days after. One patient stated that for four consecutive days commencing five days before admission he had taken daily a small crystal of picric acid. In the two fatal cases there was no evidence as to the amount of picric acid taken. The post-mortem examination showed all the tissues and fluids coloured yellow, without any gross lesions to be identified with the poisoning, and there was no histological examination.

Most of the patients were Esthonians or Letts; the Russians were less in number, but in particular belonged to the 'Old Believers'; Lithuanians and Tartars were fewer. The percentage of Jews was very small, and there were no Baltic Germans (Deutsch-Balten). W. G. S.

**Heinemann, F.** Gedanken über einige chirurgische Beobachtungen in der Türkei. [**Surgical observations in Turkey.**] *Deutsche med. Wchnschr.*, 1919, **45**, 855.

During nearly three years of service as a surgeon in Turkey, Heinemann had the same experiences as those described by F. Brüning in his paper on surgery in patients who are under-nourished and weakened by chronic disease. Heinemann served in Gallipoli, Thrace, and for the longest period at Smyrna, where he had had also to do with civil patients. The greatest number were Anatolian Osmans, next came Levantines, and

Arabs were the smallest in number. In Thrace the winters were icy cold, with frequent rain-storms, or raw, foggy, and cloudy days. The summer months were unbearably hot and dusty. In Smyrna for 9 months the sun shone in a blue and cloudless sky almost continually. The Turkish soldiers as well as the civil population were underfed, sometimes the former were as short of food as the latter. The hospital patients in bed were worse off still: early morning and evening—there was no midday service—a bowl of food was brought to the bedside. The man had to eat or go without; if he could not, the bowl was carried away full, as it was brought, without any notice being taken of the fact that the patient had not touched his food. In this way patients in hospital died of starvation.

Insufficient and irrational feeding was the cause of anaemia, and greatly increased the severity of dysentery and malaria. In all surgical cases there was a lack of tendency to rapid healing, a diminished resistance under surgical operations, and a lessened power to bear pain.

Infected wounds of joints and fractures of bones invariably did badly and tended to a fatal termination, also cases of frostbite. Primary amputation was thus generally indicated, although many died directly after an operation. Regional anaesthesia had no better success than general anaesthesia. If the patients survived the operation, there were no regulations in Turkey to help those who had lost a limb. The only chance was the life of a beggar.

In Adrianople Heinemann saw many cases of noma, ulcerative stomatitis, and Vincent's angina; those weakened by scurvy or previous starvation were especially attacked. There were also among the Turkish soldiers in Thrace numerous cases of mixed, exhausting infections—malaria and dysentery, diarrhoea and ulcerative sore throat, pneumonia and scurvy or typhus. Such was the state of general nutrition that a whitlow or a boil without general disturbance or lymphangitis or lymphadenitis, in such a patient, was a sure indication that he would die. It was not because of the extension of the local infection; vaccinotherapy had no influence; simply the heart failed.

After a slight wound or operation, even a change of dressing, or indeed whilst a wound was making good progress, the patient would be severely attacked by malaria. It was difficult with the means at disposal to distinguish types of recurring attacks of malaria from true relapsing fever. The only thing that could be done was to give small doses of quinine daily to all.

Haemorrhoids and prolapse of the rectum became very frequent. The irritation of the lower bowel by dysentery was not the only cause. The Turk squats on his heels, not only in defaecation, but at meals, at work, and even when resting at midday. Also he often urinates so, and as urethral stricture is common, there is excessive strain upon the pelvic floor.

In the first months of 1916 in Thrace, there were many cases of scurvy. The troops withdrawn from Gallipoli to rest were afflicted in three ways, with dysentery, relapsing fever, and scurvy, which is not to be wondered at, as the health of all the troops was frightfully bad. Even in warm and sunny Smyrna with abundance of vegetables and fresh foods, there were still cases of scurvy, but of a relatively mild type. On the other hand, fresh vegetables and foods containing vitamines were lacking among the troops stationed along the Dardanelles. Worse still were the conditions prevailing between Gallipoli and Adrianople, on the three weeks' march over the mountains in the neighbourhood of Kesham, in damp and icy cold weather, in thin outer clothing and no underclothing, and wood and charcoal lacking at night. The only parallel Heinemann could recall was what he had read of the French Army as it retreated across the Beresina.

Scurvy was complicated by large and deep haematomas, especially in the calf muscles. It was of the greatest importance that such haematomas should not be cut into, even although they were not absorbed for a long while. A Turkish surgeon once did so. There were conjectures that scurvy might have an infectious basis—it arose in hospital and spread after fresh admissions; the huddling together in closed rooms owing to the rooms not being heated, was blamed by some.

Surgical tuberculosis is widespread and is most frequent in Turkey, among children and those in middle life, and that among all ranks. Glandular, joint, and bone tuberculosis are the commonest, but there were seen numbers of cases of tuberculous disease of soft tissues, e.g. tuberculous peritonitis with exudation. The Arabs appeared to be specially affected both as regards frequency and severity. Surgical tuberculosis was not only much more common than in Germany; it was much less a chronic disease; moreover the sunlight treatment even in Asia Minor during the summer was less efficacious. Some benefit was afforded in glandular and peritoneal tuberculosis with exudation, but none at all in joint and bone tuberculosis.

W. G. S.

## NEUROLOGY

**Plaut, F.** Die Behandlung der Lues des Zentralnervensystems. [**The treatment of syphilis of the nervous system.**] *Ztschr. f. d. ges. Neurol. u. Psychiat.*, 1919, **17**, 5, 385.

This interesting paper contains a critical discussion of the indications and methods of treatment of syphilis of the nervous system from the earliest stages to that of the development of tabes dorsalis and general paralysis, and should be consulted by those interested in this subject.

Numerous observations have shown that a meningeal reaction, manifested by an increased cell and globulin content in the cerebrospinal fluid, is the rule in early syphilis. As soon as a positive Wassermann reaction appears in the blood in primary syphilis, changes in the cerebrospinal fluid are present in 84 per cent. of untreated cases. These changes reach a maximum during the secondary stage of the disease, and probably disappear subsequently in the majority of instances.

Nor does it appear in cases of syphilis which later develop cerebrospinal symptoms, tabes, or general paralysis, that such changes persist throughout the period intervening between primary manifestation and the development of nervous symptoms, since patients under observation for a period of years have shown normal fluids during the years immediately preceding the onset of these diseases.

The majority of long-standing symptom-free syphilitics are found to have a normal cerebrospinal fluid.

The Wassermann reaction in the blood in early syphilis and the meningeal reaction do not necessarily run parallel, and under treatment the fluid may return to normal before the blood reaction. On the other hand, when both blood and fluid have become normal, any recrudescence of fluid changes is usually preceded by the reappearance of a positive reaction in the blood.

The early meningeal reaction does not necessarily indicate the probability of later nervous sequelae, but in this respect a meningeal reaction in long-standing syphilis has a more serious import.

The practical conclusion is that the ideal time to treat syphilis from the point of view of the nervous system is during the primary stage, when the Wassermann reaction is still negative and spirochaetes have not yet invaded the nervous system. However, the early meningeal reaction is generally capable of resolution under energetic treatment.

Moreover, it follows, since the Wassermann and cerebrospinal fluid findings do not run always parallel, that the state of the fluid is the criterion by which we must judge the result of treatment, as far as the nervous system is concerned, and our object must be to render this normal.

This obviously necessitates numerous lumbar punctures as a control of treatment, and it is to be feared that the rules laid down by Plaut are, as he himself observes, somewhat of the nature of counsels of perfection, since but few patients without nervous symptoms will submit to so strenuous a régime.

The scheme of treatment of early syphilis described by Plaut is that of Dreyfus, and is as follows: An initial ten days' course of mercurial inunction, or a series of grey oil injections at three-day intervals (five injections of 0·2–0·5 grm). If no temperature reaction follows this a series of daily graduated neosalvarsan injections is begun, commencing with 0·15 gr., and increasing by this amount till a dose of 0·6 gr. is attained. Should any rise of temperature follow, an interval of two days is allowed and injection of a smaller dose resumed. In all 1·5 to 2 gr. are given in this way.

This constitutes a course of combined treatment, but to attain permanently a normal cerebrospinal fluid it is generally necessary to repeat this three times at two-monthly intervals. For, even should the fluid return to normal after the first course, if the Wassermann reaction in the blood is still positive, further treatment is indicated on general principles.

Before treatment, and about eight weeks after each course, and at yearly intervals for the two succeeding years, lumbar puncture and the examination of the cerebrospinal fluid should be carried out as a control.

In long-standing syphilis, an abnormal cerebrospinal fluid is less readily amenable to treatment, and this difficulty increases to practical absence of response in tabes dorsalis and general paralysis.

In these conditions, Nonne states that treatment—that is, with antisyphilitic remedies—must be guided by clinical indications, such as improvement of pain, crises, and sphincter disturbances.

Nonne believes that in progressive cases of tabes combined mercury and salvarsan treatment is indicated, but in absolutely stationary cases with no signs of active disease only general constitutional treatment is required.

In general paralysis, modes of treatment increase in number and complexity, and seem, indeed, in the inverse proportion to their efficacy in this respect. There is no unequivocal evidence that either salvarsan treatment or the use of agents such as tuberculin to produce pyrexia, or the production of hyperleucocytosis, have any constant or definite good results. Reports depend largely upon the enthusiasm of the inventors of many of the therapeutic methods described, as Plaut implies, when he speaks of the marvellous results claimed by some observers with every treatment they touch.

The paper concludes with chapters on the intradural application of antisyphilitic remedies, and the dangers of salvarsan. F. M. R. W.

**Dreyfus, G. L.** Silbersalvarsan bei luetischen Erkrankungen des Nervensystems. [**Silversalvarsan in the treatment of syphilis of the nervous system.**] *München. med. Wchnschr.*, 1919, **31**, 864.

The basis of exact experimental chemotherapy is the 'chemo-therapeutic index'; that is, the ratio between the smallest curative and the greatest tolerated dose of the drug under investigation.

$$\text{Index} = \frac{\text{smallest curative dose}}{\text{greatest tolerated dose}} \text{ or } \frac{C}{T}$$

For the old salvarsan preparations this was 1 : 10, for silversalvarsan it is as 1 : 30.

In animals accordingly silversalvarsan is three times as efficacious as the old preparations. It acts more rapidly, its toxic dose is higher, and it has the advantage of a combined silver and arsenic effect.

If this combination should prove of value it may replace the older less satisfactory salvarsan-mercury cure, which, in the case of nervous syphilis, the writer regards with ever increasing dissatisfaction.

Nevertheless, extreme caution is necessary in judging of the value of new preparations as applied to syphilis of the nervous system, where results are so hard to estimate. The criterion is to be found in the effect produced upon the reactions in the cerebrospinal fluid, and the ideal test case is one of early cerebral syphilis.

**Technique.** A glass syringe of 30 c.c. capacity with no metal fittings is used. Sterilization is carried out in an enamelled iron vessel, and a platinum-iridium needle (never steel) is used.

The silversalvarsan, a rapidly oxidizable brown powder, is put directly into the syringe, which is then filled (25–30 c.c.) with sterile distilled water. Solution is rapidly effected if the syringe be laid momentarily on its side.

Injection must be carried out at once into a vein in the ordinary way, but it must be gradual and spread out over two or three minutes.

**Dosage.** The provocative effect of too small doses must be borne in mind as well as the possible toxic effects of over-dosage. In outpatients greater care is necessary than in those kept under care and observation. Dreyfus gives two doses weekly, beginning always and in all stages of nervous syphilis with small doses: 0·05, increasing by 0·025 gr. at each injection up to 0·2 gr. If subjective symptoms arise, or a febrile reaction, the series is stopped until all reaction has subsided, when the injection of the smallest dose is resumed as at first.

In all, from 2 to 4 gr. are given in this way, a maximum single dose in a healthy adult being 0·2–0·25 gr. Such a course lasts from 6 to 8 weeks. This is the regime advocated for cerebrospinal syphilis or in symptom-free patients, with the characteristic changes in the cerebrospinal fluid. In tabes, smaller single and total dosage is indicated according to the general condition of the patient and the occurrence of crises.

**Results.** The best results are obtained in early cases of syphilis. In these, subjective and objective symptoms show marked signs of regression within two weeks. The cerebrospinal fluid also reacts rapidly. The headache, giddiness, lethargy, loss of memory and other symptoms rapidly improve.

Tabetics are somewhat sensitive to silversalvarsan and may show increased subjective discomforts, such as aggravated lightning pains. Of 33 cases treated, 25 showed, however, definite subjective improvement. In these, small dosage was employed.

**After-Effects.** It is stated that no evil effects ever resulted after injections of silversalvarsan in the series recorded. Immediate subjective discomforts are rare and minimal when they occur. In three cases there was a transient scarlatiniform rash, not associated with pyrexia or subjective symptoms.

On the whole, for syphilis of the nervous system, the author regards silversalvarsan as a distinct improvement on the older preparations. It has certain of the advantages of a combined silver-arsenic treatment, and since he has come to regard uncombined salvarsan treatment as preferable to combined treatment with mercury, silversalvarsan must be regarded as a marked advance upon this method also. F. M. R. W.

**Sichel, M.** Die Paralyse der Juden in sexuologischer Beleuchtung. [**The sexological aspect of general paralysis in Jews.**] *Ztschr. f. Sexualwissenschaften,* 1919, **6**, 98–104.

General paralysis among the Jews is of recent date. While epilepsy in its various forms has been prevalent among them from time immemorial, general paralysis has only become frequent among them within the last 50 years. The sudden increase in the disease coincides in point of time with their leaving the country for towns, and especially large towns, where the life with its opportunities for sexual excesses of all kinds offers the most favourable soil for dissemination of venereal infection.

In Vienna Hirschl found that among 200 cases of general paralysis 20 per cent. were Jews, and Pilez found almost the same number among his patients. According to a table compiled by Weldler from the Austrian statistics of insanity, general paralysis occurred in 7·77 per 100,000 Jews. In Frankfurt asylums for 1906–7 Sichel found that the Jews contributed 12·5 of all cases of general paralysis as compared with 8·3 per cent. of the non-Jewish inmates of the asylums. On the other hand, Hoppe in the course of 12 years at the Allenberg asylum, whose patients come chiefly from country districts, had only 2 cases of general paralysis in Jews. This striking contrast cannot be a mere coincidence, and forces one to the conclusion that the spread of general paralysis among Jews depends on the conditions associated with life in large towns. The fact that the disease among Jews in Eastern Europe is comparatively rare, in spite of their living entirely in towns, is due to their much stricter observation of religious practices and to early marriage.

It should be noted that the spread of general paralysis among the Jews applies only to the male sex, the disease being still rare among Jewesses. Of 127 cases of general paralysis in Jews at the Frankfurt clinique, only 9 were in women, the rarity of the disease being mainly due to the fact that until marriage the Jewish woman remains in her family away from the dangers of the other world.

Almost all the cases of general paralysis in Jewesses seen by Sichel

occurred in married women, in only two of whom could it be proved that they had been infected by their husbands. Until the last 20 years general paralysis among the Jews was almost confined to the upper ranks of society, but of late it has shown a tendency to affect all classes, including the very lowest.
J. D. R.

**Lemoine, A.** Rapidité anormale d'évolution de la paralysie générale chez les combattants. Étude de psychiatrie de guerre. [**On the abnormally rapid course of general paralysis developing in men on active service.**] *Thèses de Paris*, 1919–18, **126.**

Clinically general paralysis in combatants is distinguished from the disease under ordinary conditions by the following features: 1. Wild flights of imagination and megalomania, which are usually so pronounced, are exceptional. 2. The disease passes without transition from the mental confusional state into the period of dementia. 3. Remissions, which are frequent and sometimes long under ordinary circumstances, are the exception.

Fatigue, emotion, overwork, intoxication, and especially concussion, in short, all the defective hygienic conditions inherent in the life of the soldier on active service are factors in the sudden appearance, rapid course, and aggravation of the disease. Under these conditions, therefore, general paralysis may be regarded as a disease aggravated by military service. The thesis contains the histories of 11 patients, in whom the duration of the disease ranged from 3 to 13 months, half the cases lasting less than 6 months.
J. D. R.

**Valente, F. P.** Sur l'étiologie et la pathogénie de la paralysie générale. [**On the aetiology and pathogenesis of general paralysis.**] *Arq. do Inst. Bact., Camera Pestana*, 1918, **5**, 29–88.

Valente, of Lisbon, performed Neissen-Pollack's cerebral puncture in 40 cases of general paralysis to determine the frequency of the *Treponema pallidum* in the brain during life. The operation was carried out under local anaesthesia with ethyl chloride. A drill worked by a motor was placed 4 cm. above the middle of the orbital arch and driven down vertically to the dura mater. The drill was then withdrawn and a needle inserted, to which an aspirating syringe was attached, with which cerebrospinal fluid and brain substance were withdrawn. The white matter was separated from the cortex, and a thick suspension of the latter in cerebrospinal fluid or saline solution was examined on a dark ground. The patients stood the operation well and no complications were observed.

Positive results were obtained in 28 cases, or in 40 per cent. The presence of the organisms did not appear to depend on the date of syphilitic infection or on the duration, stage, or form of general paralysis, positive and negative results alike being found at all periods and in all varieties of the disease. All the cases were clinically typical examples of general paralysis, and the Wassermann reaction in the blood was positive in all. In the cerebrospinal fluid of the 28 positive cases the reaction was negative in 3, doubtful in 4, and positive in 21. In the cerebrospinal fluid of the negative cases the reaction was positive in 8, doubtful in 2, and negative in 2. In 11 cases the organisms were difficult to discover, and 2 hours' search was needed to find them. In 17 cases they were as numerous, or even more so than in the primary lesions of syphilis. Most of them were seen to be moving actively in the preparation with the characteristic screw movements and lateral flexion. J. D. R.

**Strohmayer, W.** Reflektorische Pupillenstarre und Westphalsches Zeichen als Anlageanomalie. [**Congenital Argyll-Robertson pupil and absence of knee jerks.**] *Neurol. Centralbl.*, 1919, **13**, 418.

A series of cases is recorded in which one or both of the above signs were present in patients, in whom they remained the only objective signs of nervous lesion over a period of years. In the recently observed examples a negative Wassermann reaction in the blood was obtained.

In every instance the patients themselves, or members of their families over several generations, presented various stigmata of degeneration, and the conclusion is reached that these phenomena may occur in very rare instances as a manifestation of an hereditary degenerative tendency.

Since the Argyll-Robertson pupil and Westphal's sign (absence of knee jerks) are among the cardinal signs of syphilis of the nervous system, the establishment of their incidence as stigmata of degeneration in non-syphilitics is of some interest. F. M. R. W.

**Pfeifer, B.** Über corticale Blasenstörungen und deren Lokalisation bei Hirnverletzen. [**The cortical localization of bladder disturbances.**] *Ztschr. f. d. ges. Neurol. u. Psychiat.* (Originalien), 1919, **46**, 3, 173.

In a series of 200 cases of gunshot wound involving the brain, the author observed 20 cases of disturbed vesical function. Of these seven had a right-, six a left-sided, and seven a bilateral lesion.

The symptom consisted in retention of urine necessitating catheterization at first, followed by incontinence of urine ('imperative Inkontinenz'). These disturbances persisted for several weeks before clearing up.

Right- or left-sided lesions were equally productive of this defect, but with bilateral lesions the disturbance was more intense and longer lasting, indicating a bilateral cortical representation of the bladder.

The relative infrequency of this symptom of cortical injury seems to suggest that the bladder area of the motor cortex is small, and cranio-cerebral topographical observation places this 'near the hip centre, and between the arm and leg areas'. There also seems evidence that the bladder is represented in the corresponding region of the post-central convolution: a sensory representation. F. M. R. W.

**Marie, P.**, et **Béhague, P.** Syndrome de désorientation dans l'espace consécutif aux plaies profondes du lobe frontal. [**Disorientation in space as a symptom in deep wounds of the frontal lobe.**] *Rev. Neurol.*, 1919, **1**, 3.

The symptomatology of pure lesions of the frontal lobes is but incompletely elucidated. These authors describe a new symptom peculiar to deep penetrating wounds of the frontal lobes (région préfrontale), which they have observed in twelve cases. It consists in an impairment or loss of the sense of direction, and it is found in the complete absence of any other objective sign of injury of the brain.

In the more severe cases the patient loses his way about the hospital corridors or in the streets, and is unable to decide whether to turn to the right or the left to reach his desired objective, unless he can actually see this. After a walk in the garden such a patient can only regain his ward in hospital if he has chalked up directions for himself upon the angles of the walls.

At night, or in the dark, when deprived of the aid of vision, the defect is aggravated, and a patient walking upstairs to his bedroom in the dark does not know where to turn to find the door.

In less severe cases the defect may be elicited by closing the patient's eyes and turning him round, when his sense of direction is most readily lost.

All the cases show remarkable freedom from the subjective symptoms usually found after breaches in the cranial vault, such as headache, giddiness, transient dimming of vision.

The lesion may be right- or left-sided, or bilateral. It is essential that it should be deep. Marie and Béhague suggest that interruption of the bulk of the association fibres connecting the frontal with the other lobes of the hemispheres, such as requires a deep lesion for its production, may be the cause of this symptom. F. M. R. W.

**Lhermitte, J.** Sur la régénération de racines postérieures dans la section complète de la moelle dorsale. [**Regeneration of posterior roots after section of the dorsal cord.**] *Rev. Neurol.*, 1919, **2**, 129.

A histological study of four completely transected cords by Bielschowsky's method revealed the presence of newly formed axis cylinders in the superior end of the isolated portion of the cord, never at the extremity of the proximal portion.

The new fibres are grouped in small bundles, are tortuous and intertwined and run in all directions. They are found in the midst of the necrotic tissue at the sectioned end, around vessels, lying in the Virchow-Robin spaces, and in the meninges. These fibres arise solely from the posterior roots, and penetrate the pial sheath, and spread in the necrotic tissue. The anterior roots and the tracts passing up and down in the cord show no signs whatever of regeneration.

It is of interest that the only fibres showing evidence of restoration should be those normally provided with a sheath of Schwann.

It seems probable from the disorderly distribution and mode of growth of these fibres that they cannot be expected to lead to any restoration of function. F. M. R. W.

**Marinesco, G.** Autonomie de la moelle consécutive à la section complète de l'axe spinal. [**The autonomy of the transected cord.**] *Rev. Neurol.*, 1919, **4**, 257.

Bastian's law, as numerous observations in France and in this country during the past four years have proved, only holds for the initial phase, or phase of spinal shock, of spinal transection. Longer survival of patients under modern conditions, and with the cleaner cut lesions produced by modern weapons as compared with the lesions of disease, have revealed the fact that the cord once emerged from shock develops an intense reflex activity of its own.

The question is asked whether this activity is the resumption of the normal activity of the cord, or more probably a new and altered form of function characteristic of the isolated cord.

The physiology of muscle tone as, following the conceptions we owe to Sherrington, it is now understood, is reviewed at some length, and the author reaches the conclusion, already formulated in this country by Walshe (1914) and by Head and Riddoch (1918), that the postural tonus of the extensor group of muscles of the lower limbs does not return after complete transection of the dorsal cord, and that the reflex activity of the isolated part of the cord in man is purely flexor.

It may be questioned, however, whether he is right in regarding this characteristically phasic type of activity as an expression of 'tonus' in these muscles. If so, then the expression loses its physiological significance, while his statement that 'the reappearance of the tendon reflexes runs parallel with the degree of tonus', also does not accord with modern physiological conceptions. F. M. R. W.

**Roussy, G., D'Œlsnitz, et Cornil, L.** Section totale de la moelle dorsale par contusion rachidienne (Fractures des apophyses transverses de D. 9, D. 10) avec conservation des réflexes rotulien et achilléen gauches, présence de réflexes d'automatisme médullaire 18 mois après le traumatisme. [**Complete section of the dorsal cord with preservation of the left knee- and ankle-jerk, and presence of the reflexes of spinal automatism 18 months after the injury.**] *Ann. de méd.*, 1919, **6**, 150–9.

The clinical signs presented by the patient 18 months after the wound were complete flaccid paraplegia, with anaesthesia to tactile, thermal, and painful stimulation. The left knee-jerk was preserved and was sometimes accompanied by left knee clonus, while the left ankle-jerk was apparently quite normal. The reflexes of spinal automatism were quite distinct on either side. The mass reflex was obtained by injection of fluid through the cystotomy wound, and by change of temperature or pressure of the fluid. The necropsy showed the disappearance of all spinal cord tissue at the level of the 10th dorsal vertebra for a length of 1½ cm. The upper part of the lower fragment was constituted by a globular swelling. On histological examination at the level of the lesion there was an absence of all spinal cord tissue, and some regenerating fibres were seen on the anterior surface of the meninges. Below the lesion the ganglion cells were intact at the level of D 12, L 1, L 2, L 3, and the degeneration of the pyramidal fibres and posterior columns did not extend beyond L 2. The writers think it more likely that the lower segment progressively recovered its functions of spinal automatism than that the regenerating fibres in the meninges conducted the reflex arc to the upper segment. J. D. R.

**Drécourt, E.** Le syndrome de Claude Bernard-Horner par blessures de guerre. [**Claude Bernard-Horner's syndrome due to war wounds.**] *Thèses de Paris*, 1918–19, **114**.

The principal constituents of the Claude Bernard-Horner syndrome, which is due to a lesion of the sympathetic, are myosis, ptosis, and enophthalmos, while the others, which are less constant, consist of vaso-motor and secretory changes and a modification of the ocular tension. In war wounds the syndrome is frequently accompanied by other disturbances, especially a lesion of the brachial plexus or one of the last four cranial nerves in the retro-parotid space.

A dissociation of the syndrome frequently occurs, the vaso-motor symptoms being observed least frequently. This dissociation is explained by the fact that the sympathetic which contains vaso-dilator and vaso-constrictor fibres is only partially damaged and is not completely divided as in physiological experiments. As the syndrome does not cause any disturbance of vision, surgical treatment is not required. The patient cannot justly lay claim to a pension and should be retained in the army. J. D. R.

## PATHOLOGY AND BACTERIOLOGY

**Kendall, A. I., Day, A. A., Walker, A. W., and Ryan, M. The fermentation reactions of certain streptococci.** *J. Infect. Dis.*, 1919, **25**, 189.

The authors have carried out an investigation into the fermentation reactions of 356 cultures of streptococci obtained chiefly in military camps in the United States from streptococcus pneumonia, empyema, blood cultures, and autopsies. The fermentation tests were made on sugars and kindred substances obtained from the Carbohydrate Laboratory of the Department of Agriculture. The cultures were isolated on plates of rabbit blood agar (10 per cent. blood), and subsequently cultured in serum broth containing the carbohydrate. All the strains fermented d-glucose, d-mannose, fructose, d-galactose of the hexose group ; maltose, lactose, saccharose, and trehalose of the biose group, and salacin of the glucoside group. All cultures gave in addition a strongly acid reaction in milk, and none produced liquefaction of gelatin. The authors consider tentatively that these are fundamental characters of the streptococcus group investigated by them.

The following substances were not fermented by any of the strains studied :

1. Pentose group. D-arabinose, d-arabite, rhamnose.
2. Hexose group. Dulcitol.
3. Heptose group. Alpha-gluco-heptose, manno-keto-heptose, and perseitol, anhydro-sedo-heptose.

They consider that mannitol, raffinose, and inulin are fermented by a sufficiently large proportion of strains to possess a differential value. The primary isolation of pure cultures on blood agar showed also that the action of streptococci on haemoglobin was a factor of considerable differential value.

It must be remembered that all the strains tested were of human origin, and that pneumococci were not included.

The authors point out that carbohydrates are important in bacterial nutrition chiefly as sources of energy, sparing the nitrogenous constituents, although they cannot be entirely substituted for the latter, which are indispensable for the plastic requirements of the organisms.

Carbohydrates are biochemically of great importance in bacteriology, on account of the relations which exist between the stereo-isomerism of members of the group having the same empiric formula and their utilizability by different bacteria. Carbohydrates also possess value in the classification of bacteria, the significance of such a classification depending on a recognition of the relation between the space arrangement of the carbohydrate and a fundamental capacity of the microbic cytoplasm to dissociate it with the liberation of energy for the cell. The authors point out, however, that there is no clearly discernible relationship between cultural grouping based on carbohydrolysis and pathogenesis. W. B.

**Havens, L. C. A biologic classification of hemolytic streptococci.** *J. Infect. Dis.*, 1919, **25**, 315.

The basis of the experiments was furnished by a series of strains of haemolytic streptococci from different sources, which included throat cultures from healthy carriers (80 cases), from cases of acute bronchitis (60 cases), from patients suffering from measles (9 cases), and from cases of tonsillitis and sore throat (30 cases). Sputa from cases of pneumonia (20 cases), and lung cultures after death (21 cases), empyema (67 cases), gunshot wounds (4 cases) were included. along with 1 case of renal infection. The total strains examined numbered 292, and they were all isolated on blood agar. Agglutination reactions were carried out with the sera of rabbits immunized with cultures of haemolytic streptococci, the test emulsion being living cultures of cocci grown for 12–16 hours in blood (10 per cent.) broth. Incubation took place at 37° C. for 4 hours, and the tubes were then placed on ice overnight. With the first serum 139 strains (47 cent.) of the 292 cultures were agglutinated in dilutions of 1:1000 or higher, the remaining 153 being unagglutinated or only to a titre of less than 1:100. One of the strains which failed to agglutinate was then utilized for the production of an immune rabbit serum with which 54 strains (19 per cent.) were found to agglutinate these two series taken together, including 191 (66 per cent.) of the 292 members of the group tested. A third group, comprising 79 members (27 per cent.), was obtained by similar methods. Thus three groups of haemolytic streptococci (93 per cent.) were differentiated. Bactericidal experiments also agreed in general with the agglutination tests, i. e. strains were killed by the same serum with which they were agglutinated, but not by serum of another group. At the same time, however, the author found that certain strains were interrelated in their agglutinogenic properties, and were not so differentiated as in the case of pneumococci. Experiments with mice inoculated with strains of streptococci exalted by passage: It was found that protection could be afforded to these animals by homologous serum, each of the sera corresponding to the three groups of haemolytic streptococci being more or less specific. W. B.

**Richey, De W. G. Experimental streptococcic tonsillitis, the apparent inefficacy of streptococcic vaccine as prophylactic.** *J. Infect. Dis.*, 1919. **25**, 299.

This paper deals with the occurrence of 16 cases of tonsillitis, which developed during the course of experiments on human volunteers who had been infected with secretions from influenza patients. These experiments were carried out by medical officers of the U.S. Navy and the U.S. Public Health Service, in an attempt to ascertain, if possible, the mode of dissemination and cause of influenza. The results of this mass experiment will be published later, the present communication dealing only with the occurrence of a few cases of tonsillitis. The volunteers belonged to three groups, two at Boston and one at San Francisco. There were 155 men altogether of the

U.S. Navy, and the San Francisco group, 50 in number, had been inoculated prophylactically, about one month before, with a vaccine containing *B. influenzae*, pneumococcus (types I, II, and III), and *Streptococcus haemolyticus*. The other two groups had not received a vaccine. On the 155 men 226 inoculations were made, of which 124 consisted of the transference of crude nasopharyngeal washings and bronchial secretions from cases of influenza into the noses and throats of 86 different men. Sixteen of these developed tonsillitis. In one of the Boston groups of 62 men only 1 case of tonsillitis developed among 32 men inoculated. In the second Boston group of 61 inoculations there were 12 cases of tonsillitis, 6 occurring in one squad where, in an endeavour to obtain an early case of influenza, nasopharyngeal washings and bronchial secretions were procured from an individual who was suspected to be developing influenza, but who later was proved to have tonsillitis. In the San Francisco group (of men who had been inoculated with the above-mentioned vaccine) there were 3 cases of tonsillitis of 14 men who were sprayed with influenzal secretions. All the cases of tonsillitis made an uneventful recovery. In every case a haemolytic streptococcus was found to be the chief microbe in cultures taken from the tonsillar exudate. The cultures of streptococcus, both from donors and recipients, corresponded to *S. pyogenes*. W. B.

**van Loghem, J. J.** Bacterium (proteus) anindologenes bei gesunden und kranken Säuglingen. [**Bacterium (proteus) anindologenes in healthy and sick babies.**] *Centralbl. f. Bakteriol.* (&c)., 1919, Orig. **82**, 449.

van Loghem originally isolated anindologenous strains of proteus from the urine of a patient suffering from pneumaturia and from an abscess of the abdominal wall, presumably connected with the bowel. Other strains were subsequently isolated by van Loghem and his wife (Loghem-Pouw) in Medan (Sumatra), by Baudet in Leiden, and by Elders in the Hague from a case of Indian sprue. Groot studied 16 strains of proteus isolated from 26 babies, and found that 8 were anindologenous. In the present paper, van Loghem says he has never found anindologenous strains in putrid meat, manure, or earth, but on one occasion cultivated a strain from the faeces of a rabbit. He discusses the significance of proteus in general in connexion with infantile diarrhoea, and refers particularly to the researches of Metchnikoff, Bertrand, and Tsiklinsky from 1914 onwards. As is well known, Metchnikoff attributed to proteus a preponderating rôle in the production of summer diarrhoea in children, having found cultures of this microorganism 204 times (93 per cent.) in 218 cases examined. Bertrand found it in every one of 55 cases examined, while Miss Tsiklinsky found it 51 times (65 per cent.) in 78 cases. With regard to the occurrence in normal cases, there were very considerable divergences, for Metchnikoff found 51 per cent. affected in 39 normal children, Bertrand found only 8 per cent. in 24 cases examined, while Tsiklinsky found 20 per cent. to harbour proteus among 40 babies examined. van Loghem has extended the series. Two methods of examination were practised, viz. a 'direct' one, in which the inoculum from the faeces was transferred directly to the condensation water of an agar slope, and an 'indirect' one, in which enrichment was carried out in broth before inoculation on agar. His results are tabulated as follows:

| | | Direct Method | | Indirect Method | |
|---|---|---|---|---|---|
| | No. of Cases | *P. anindologenes* | *P. vulgaris* | *P. anindologenes* | *P. vulgaris* |
| | | per cent. | per cent. | per cent. | per cent. |
| Healthy breast-fed children | 55 | 3·6 | 0.0 | 7·3 | 10.9 |
| Healthy bottle-fed children | 17 | 23·5 | 23·5 | 11·8 | 47·0 |
| Ill (not intestinal) bottle-fed children | 63 | 17·5 | 22·2 | 14·3 | 47·6 |
| Bottle-fed children with alimentary diseases: Summer diarrhoea, Acute enteritis, Alim. toxaemia | 31 | 51·6 | 22·6 | 22·6 | 64·5 |
| Bottle-fed children with alimentary diseases: Dyspepsia and Decomposition | 63 | 15·9 | 20·6 | 11·1 | 61·9 |

His inferences are that *P. anindologenes* occupies a special position in connexion with summer diarrhoeas. Whereas *P. vulgaris* (i. e. *indologenes*) in all groups (except breast-fed babies) gives almost the same percentages, viz. 23·5, 22·2, 22·6, and 20·6, the anindologenous races occur in summer diarrhoea to the extent of 51·6 per cent. *P. anindologenes* occurs especially in artificially fed babies, and can grow and flourish in the acutely diseased bowel, although it is not proved to be the aetiological agent of infantile diarrhoea. He considers, however, that it can manifest pathogenic properties. W. B.

**Schürer, J.** und **Wolff, G.** Ueber die Bedeutung der Proteus-Bazillen beim Fleckfieber. [**On the significance of proteus bacilli in typhus.**] *Centralbl. f. Bakteriol.* (&c.), 1919, Orig. **82**, 517.

The nature of the Weil-Felix reaction is still a matter of dispute, which Schürer and Wolff, on the basis of extensive observations, have attempted to clear up. If the proteus named ‘X 19’, which was originally isolated by Weil and Felix, were the cause of typhus fever, as has been maintained by Friedberger, one would expect that it would have been found relatively often, but such is not the case. Out of the very large numbers of cultures made from blood and urine by Weil and Felix, Dienes, Rotky, Gergely, Zeiss, and others, it has been found in only a small percentage of cases. Felix himself, in a series of 419 samples of blood from 250 cases of typhus, was unable to recover the bacillus in a single instance. On the other hand, Zeiss, in 277 blood samples, found it 18 times, while from 78 cases of typhus G. Wolff found it 8 times. In 350 blood samples from 260 typhus cases with high fever, Schürer and Wolff found typhus-proteus 20 times, i. e. in 7·7 per cent. of the cases examined. In 55 blood samples obtained from undoubted cases of typhus before the onset of the Weil-Felix reaction, they found proteus of the type X 19 six times. Besides these blood tests they examined 450 catheter specimens of urine from 95 cases of undoubted typhus, and found proteus bacilli 137 times. These proteus bacilli were compared serologically with 72 proteus strains isolated from stools or urines from cases of enteric fever, paratyphoid fever, and dysentery.

In their studies of proteus Braun and Salomon (1918) had recognized three serological groups, I, II, and III. In Group I were included strains which showed a minimal agglutinogenic relationship or none at all with typhus-proteus strains.

Their Group II included strains which showed some, but in general feeble, agglutinogenic relationships with typhus-proteus, while their Group III were the genuine typhus-proteus highly agglutinable bacilli. The 72 strains of proteus mentioned above were found by Schürer and Wolff to fall into Groups I and II, i.e. they were found to be not agglutinated at all, or only to a slight degree, by the serum of typhus patients. What agglutinability there was did not depend on the titre of the typhus serum for typhus-proteus races, for such a serum, with a titre of say 1:25,000, did not agglutinate these ordinary proteus strains more effectively than another typhus serum with a titre of only 1:1,600.

Of the 20 typhus-proteus strains isolated only 7 conformed to the X 19 type of Weil and Felix, while 3 others were of the type of X 2. Of the 137 proteus cultures isolated from the urines of undoubted typhus cases 16 showed an agglutination with typhus serum in higher dilutions than those of the 72 strains isolated from patients not suffering from typhus. There are probably transitions between ordinary proteus strains and those called X 19.

The authors consider that the Weil-Felix reaction is the manifestation of a proteus mixed infection, the proteus bacilli migrating from the intestine during the course of the disease. They were unable to settle the question whether proteus X-strains were varieties of ordinary proteus strains or special organisms. W. B.

**THJØTTA, TH.** (1). **On the bacteriology of dysentery in Norway.** *J. Bact.*, 1919, **4**, 355.

**THJØTTA, TH.** (2) Om Dysenteri i Norge. [**Dysentery in Norway.**] *Med. Rev.*, Bergen, 1917, **34**, 57, 109, 171, 291.

**SONNE, C.** (1). Giftfattige Dysenteri baciller. [**Hypotoxic dysentery bacilli.**] Kjøbenh. 1114, 230 p., 8°.

**SONNE, C.** (2). Ueber die Bakteriologie der giftarmen Dysenteriebacillen (Paradysenteriebacillen). [**On the bacteriology of hypotoxic dysentery bacilli.**] *Centralbl. f. Bacteriol.* (&c.), 1915, Orig. **75**, 408.

**SONNE, C.** (3). Die diagnostische Bedeutung der Agglutination der giftarmen Dysenteriebacillen (Paradysenteriebacillen) in Patientenseris. [**The diagnostic significance of agglutination in hypotoxic dysentery bacilli.**] *Centralbl. f. Bakteriol.* (&c.), 1915, Orig. **76**, 65.

**D'HERELLE, F.** Sur un bacille dysenterique atypique. [**On an atypical dysentery bacillus.**] *Ann. de l'Inst. Pasteur*, 1916, **30**, 145.

Thjøtta's paper (1) is an extract in English from his extensive publication (2) in Norwegian, and deals with the special group of mannite fermenting dysentery bacilli which C. Sonne (1) (1914) showed to be the main cause of dysentery as met with in Copenhagen and other parts of Denmark. Sonne's dysentery bacilli were independently described by D'Herelle (1916) in France, by Thjøtta in Bergen (1917), and by Oehnell (1917) in Sweden (cited by Thjøtta) These new dysentery bacilli had in general been classed as inagglutinable strains of the Flexner-Y group of mannite fermenters, and it is the merit of Sonne to have shown that they really constitute a distinct group entirely separate from a serological standpoint—a view in which he is completely supported by Thjøtta, who studied 65 strains isolated from typical dysenteries and acute diarrhoeas in Bergen and the neighbouring district. Litmus-lactose-agar plates were used for isolation, and the colonies were then tested on mannitol, maltose, sucrose, and glucose. Serologically, Thjøtta found that mannite fermenting dysentery bacilli fall naturally into two groups, which he originally classed as 'B' and 'C'.

The bacilli of the 'B' group yield small colonies and produce acid in maltose and occasionally in sucrose (fluid media). Indol production is the rule. Serologically there is some relationship to the Shiga group, but none to Group 'C' (Sonne's bacilli), in which the colonies are large. Maltose and sucrose are fermented constantly, but no indol is produced. Serologically Group 'C' has no relation to other groups, and in general the agglutination titres are low, the flocculi being very fine. Group 'C' never showed any agglutination with normal human sera, while strains of Group 'B' showed agglutination up to a dilution of 1:40.

Group 'B' includes the old types of mannite fermenters (Flexner-Y, Strong), while 'C' is the new group serologically distinct. Apart from agglutination tests, which were carried out with an emulsion of living bacilli in saline after 24 hours' growth in agar, Thjøtta also tested the Bordet-Gengou absorption of complement, using an emulsion of bacilli, heated to 60° C. for 1 hour, as antigen, and as amboceptor the same sera as those used in the agglutination test. The complement for haemolysis was titrated out before the actual test was performed. With this technique, it was found that Group 'C' was sharply demarcated from 'B', a fact which was further supported by the application of Neisser and Wechsberg's bactericidal determinations.

None of the new group of bacilli fermented lactose within the first 24 hours, although some did so later. In conclusion, the author proposes the differentiation of dysentery bacilli into three great groups, which he designates I, II, and III, instead of naming them A, B, C, as Kruse has already employed the latter to signify different types of mannite fermenters.

By this arrangement Sonne's types I and II are united by Thjøtta as Group II, while his Group I is the type Shiga, and his Group III is the type Sonne. This grouping is in accordance with the chronology of dysentery bacilli, Group I having been first discovered by Shiga, Group II being next differentiated by Flexner, while Group III was the last isolated in point of time. He considers that the new grouping will do away with the necessity of employing such terms as 'pseudo-dysentery' bacilli, 'paradysentery' bacilli, 'atoxic' dysentery bacilli, and so forth. The main characters of the three groups may be tabulated as follows:

| Groups | Serologically | Culturally | | | | |
|---|---|---|---|---|---|---|
| | | Colonies | Mannite | Maltose | Sucrose | Indol |
| Group I (B. of Shiga) | Specific. Very slight relationship to Group II by agglutination; none by other sero-reactions | Rather small. Sharp, regular edge | – | – | – | – |
| Group II (Flexner, Y, and Strong types | Slight relationship to Group I. Some individual variations of strains | Rather small. Sharp, regular edge | + | + or – | – or rarely + | + seldom – |
| Group III (B. of Sonne) | Specific. No relationship to other groups | Rather large. Uneven irregular edge | + | + | + after some days | – |

[It will be observed that in his original tables the author represents positive results as +, but his negative results are represented by the English sign of division ÷.] W. B.

**Bunker, J. W. M. Studies of the diphtheria bacillus in culture.** *J. Bact.*, 1919, **4**, 379.

In spite of the fact that diphtheria toxin has been prepared in vast quantities during the last quarter of a century, and that it is one of the most important substances employed in applied bacteriology, it still remains true that a successful result is largely a matter of chance, even when experiments are carried out under conditions which seem comparable or actually identical. Indeed, the production of potent diphtheria toxin is one of the banes of life for the person who has to undertake the manufacture of diphtheria antitoxin. In order to fathom some of the inscrutable mysteries of toxin production the author has made an extensive study of the effect of hydrogen-ion concentration upon the activities of diphtheria bacilli in culture, and while it is improbable that he has solved the whole problem, his results indicate that at least it is possible to obtain a product of more constant strength, and may be applicable to other toxins, the preparation of which are not of so much practical importance, although of great interest scientifically.

He finds that the adjustment of the culture media should be in terms of hydrogen-ion concentration. The diphtheria bacillus will grow in peptone broth of an initial reaction between $P_H$ 5·7 and 8·7. The most rapid development of the heaviest pellicle of growth was found to occur with $P_H$ 7·3 to 7·5. During the development of growth there is a primary acid production, followed by a secondary alkali formation, until the $P_H$ 8·0 is reached. A yield of strong toxin was obtained between $P_H$ 7·8 and 8·25. It was also found that Witte's peptone was heavily buffered in this $P_H$ region, whereas American peptones were not. At the same time, the reaction conditions do not entirely govern the toxin production. A peptic digest of meat having a content of polypeptids insoluble in 80 per cent. alcohol, but soluble in 50 per cent., gave favourable results. In sugar-free veal infusion containing 2·0 per cent. of this product and 0·5 per cent. of sodium chloride, a strong strain of diphtheria bacilli gave toxins suitable for immunization. An initial H-ion concentration of $P_H = 7·5$ (after sterilization) was found to be favourable. At the same time, many other factors are involved, such as the size and shape of the culture vessels, the activity of the bacillus employed, and the incubation temperature, and these must be taken into account in estimating the time necessary for the incubation, in order that the most potent toxin may be obtained. W. B.

**Davis, D. J. The effect of potassium iodide on experimental sporotrichosis.** *J. Infect. Dis.*, 1919, **25**, 124.

The excellent curative results in man obtained by the use of potassium iodide in cases of sporotrichosis led the author to study the action of the drug both on cultures and in the experimental disease in rats. It was found that *Sporotrichum schenckii* will live for at least 48 hours in a 10 per cent. solution of potassium iodide, and for 74 days in a 1 per cent. solution. The fungus also grew in a medium containing 1 per cent. of tincture of iodine.

Administered to rats before inoculation, potassium iodide has no effect in preventing the successful infection. Given curatively the drug acts promptly. The lesions in the peritoneum become firm, hard, and small, and surround themselves with a dense fibrous capsule. Within the nodules living sporotricha were found up to at least four months. W. B.

**TUNNICLIFF, Ruth. The microscopic appearances in ulceromembranaceous tonsillitis (Vincent's angina).** *J. Infect. Dis.*, 1919, **25**, 132.

The authoress had the opportunity of examining a freshly excised tonsil which clinically and microscopically was typical of Vincent's angina. The removal proved an effective measure for limiting the infection.

Microscopic sections of the tonsil showed fusiform bacilli and spirochaetes in enormous numbers in the zone separating the external necrotic epithelium and the living tissue. A considerable number were invading the normal tissue, the spirochaete forms being the more abundant and in advance of the fusiform bacilli. In the line of advancing necrosis there appeared to be no association with cocci and bacilli which were abundantly present in the exudate on the surface of the tonsil. Reference is made to the observations of Vincent, Krebs, Gross, and Ellermann on the same subject. W. B.

**CHEYNEY, E. W. A study of the micro-organisms found in merchantable canned foods.** *J. Med. Research*, 1919, **40**, 177.

This paper, which comes from the Department of Preventive Medicine, Harvard University, is an important one, and embodies the results of experiments carried out with very rigorous technique on 725 cases of merchantable foods in prime condition. The fact that the essentials of life—air, water, and food, are practically never sterile has made the problem of the feeding of large communities a matter of great importance. The main facts of sterilization are, of course, thoroughly well known, and if it were only a matter of sterilization, the problem would not be difficult, but the act of sterilization may alter the appearance of many foodstuffs, rendering them unappetizing, or in the light of present beliefs, might destroy factors of a 'vitaminic' character necessary for health. ·The practical manufacturer of canned foods is, therefore, constantly seeking a mid-point which will be the most economical and at the same time will not destroy necessary factors in the foodstuff. Preservation of foods by heating them in glass containers was the invention of Appert, of the Napoleonic period, but it was not till about 1897 that the steam retort as a sterilizing agent came into general vogue, since which time the process of making tinned foods has become a truly gigantic industry of paramount importance both in peace and war. In 1900 Vaillard was the first to examine a large number of tins of unspoiled food, especially meat, in order to determine, if possible, the source of troublesome epidemics of food poisoning in the French army. He found living bacteria in 70 per cent. of tins examined, and proved that these organisms had lain dormant for five to seven years, but could be resuscitated by aerating the tins under sterile conditions at 37° C. A large number of investigations have shown the presence of non-pathogenic spore-bearing aerobes of the *mesentericus-subtilis* group of bacilli in tins of apparently perfect food. The sources of these bacteria is a double one, namely, under-sterilization or leakage. Of course if cans are leaky they may become contaminated with any organism at hand. Contamination due to underprocessing has been found to be due to two distinct groups of bacteria, (1) spore-bearing bacilli, (2) representatives of the coli and proteus groups.

The present investigation was carried out on 725 tins of a variety of foods, meat, fish, vegetables, and fruits. All were purchased in the open market, and were incubated for at least 10 days at 37° C. before analysis. Fifty-eight out of the 725 tins (= 8·0 per cent.) were found to contain living microbes, but some foods had a constantly low percentage, others a constantly high percentage of contaminations. Fruits contained least, vegetables contained more, and fish and meats, as might have been expected, contained the highest percentage of contaminations, varying from 10 to 20 per cent.

The microbes isolated constituted a sharply limited group of resistant spore-bearing bacilli of the *subtilis-mesentericus* group, certain thermophilic bacteria, an anaerobe, and four common species each of Aspergillus and Penicillium, and two border-line yeasts. *No pathogenic bacteria were found.*

There was evidence to suggest that in certain foods the bacteria and moulds had resisted the sterilizing process, and that the usual methods of sterilization must be intensified. This conclusion of course depends on whether each can examined was bacteriologically tight or not. In order to determine this point all cans, after bacteriological examination, were tested in the Laboratory of the National Canners' Association at Washington. Here the cans were tested under pressure for leakage and the seams torn open. Although most of the cans could be definitely determined as 'tight' or 'leaky', there was a middle group which leaked only under high pressure, although under ordinary commercial conditions of packing they were 'tight'.

Of 373 cans found sterile 292 (78 per cent.) were 'tight', 50 (13 per cent.) were 'doubtful', and 31 (9 per cent.) were 'leaky'.

In view of the enormous quantities of canned foods eaten in all countries at the present time these results must be looked upon as satisfactory, and as indicating that the methods of sterilization are of a high grade.

W. B.

**Mudd, S.** and **Grant, S. B.** **Reactions to chilling of the body surface. Experimental study of a possible mechanism for the excitation of infections of the pharynx and tonsils.** *J. Med. Research*, 1919, **40**, 53.

This paper describes a method of determining quantitatively the temperature changes in skin and exposed mucous surfaces of human subjects. Temperatures are estimated by specially devised thermopiles of copper and German silver, in connexion with a sensitive D'Arsonval galvanometer (1 mm. deflection was equivalent to 0·1,004° C. temperature difference, with a probable error of 0·0037° C.).

It was found that the temperature of the skin and oral and pharyngeal mucous membranes fell with the chilling of distant areas of the body surface, and rose again with the rewrapping of the subject. No alterations of consequence were discovered in the temperature and pressure of the blood during such chillings, but there was an increase in the volume of the respiratory exchange. This latter depressed mucous membrane temperature, so respiration had to be controlled. The temperature changes were shown to be the result of changes of vaso-motor tone in the vessels supplying these surfaces. Chilling of the body surface causes reflex vaso-constriction and ischaemia in the mucous membranes of the palate, faucial tonsils, oro-, and naso-pharynx. Hitherto it has been supposed that cutaneous chilling causes congestion of mucous membranes. The effects in cases of chronic pharyngitis, acute inflammation of scar tissue, and of the soft palate were also investigated.

The authors think it not improbable that the ischaemia of the mucous membranes from cutaneous chilling might so disturb the equilibrium between host and bacteria in the tonsillar crypts and folds of the pharyngeal mucosa as to excite infection. W. A. M. S.

**Kosakai, Mitsuji. Studies in osmotic pressure.** I. **The mechanism of boric acid hemolysis.** II. **The nature of osmotic pressure.** *J. Immunol.*, 1919, **4**, 35.

This paper occupies a whole number of the *Journal of Immunology*, and in it the author endeavours to show, by a detailed study of boric acid haemolysis, that osmotic pressure is not a direct property of a solute, as is considered by many physicists. He brings forward experimental evidence to suggest that it is solely the pressure exerted by water which has passed, by the yet unexplained process of diffusion, through a semi-permeable membrane to the side of the higher osmotic concentration. W. A. M. S.

## RADIOLOGY

### *Radiotechnique*

**Holzknecht.** Röntgenoperation. [**Operation under X-rays.**] *Berl. klin. Wchnschr.*, 1918, **13**. (*Centralbl. f. Chir.*, 1919, **46**, 132.)

Operation under X-rays is recommended for other purposes besides the removal of foreign bodies ; for controlling the surgical procedure in infectious disease of the bone, in lithotripsy, in the high operation and in nephrotomy for stone, and in operation for lung abscess. Also during operations on the digestive tract the use of X-rays gives many advantages, and the presence of the necessary contrast-meal is not a disturbing element. S. L.-B.

**Berti** ed **Urban.** Azione della stricnina sulla motilità dello stomaco e sul progresso del cibo lungo il canale gastro-enterico. [**The action of strychnine on the motility of the stomach, and on the progress of food along the gastro-intestinal canal.**] *Arch. di farmacol. sper.*, 1917, **12**. (*Radiol. med.*, 1919, **6**, 223.)

In these experiments cats were fed on a bismuth-carbonate meal, made up to the consistency of porridge, with purée of potato and a little milk, after 24 hours' fast. In the first series, strychnine was given hypodermically.

*Experiment A.* Dose 1 to 2 cmg. per kilo of body weight, with the meal. For the first half to one hour, there was increased peristalsis, and more rapid emptying; this was succeeded by a period of slowing, with constriction of the mid-stomach and pylorus, giving an hour-glass appearance.

*Experiment B.* Dose 5 cmg. in proportion at meal-time. The above first stage not seen, but there was slowing from the first. There was dilatation of the cardiac end, hypertonus, and spasm of the pyloric end. There was often contraction in the middle, giving a bi-lobed effect. The total emptying time was twice the normal.

*Experiment C.* Dose 10 to 12 cmg. The results were as in B, but more pronounced, the emptying taking three times as long as normal.

*Experiment D.* The dose given at varying intervals after the meal. There was sudden stopping of movement and then a period of slow movement, but what was already in the small intestine was passed on very rapidly.

In the second series the strychnine was given by the mouth. *Dose* $1\frac{1}{4}$ *cmg. per kilo.* There was slight increase, followed by contraction and slowing of peristalsis. Emptying took 4 hours instead of $2\frac{1}{2}$. *Dose* 5 *cmg.* There was increase at first, but after an hour there were seen tonic contraction and bi-lobed stomach, with food motionless in each lobe. Emptying took twice the normal time.

*Big dose:* 10 *to* 20 *cmg.* No slowing, but increased peristalsis. The stomach emptied in 2 instead of $2\frac{1}{2}$ hours, nearly as much being emptied in the first hour as normally in two hours.

The authors conclude that with a normal cat bismuth appears in the colon before the stomach is quite empty. After hypodermic or oral administration of strychnine this is delayed, but the retarding takes place in the stomach rather than in the intestine. With big doses there is a general speeding up, again in the stomach rather than in the intestine. N. B.

**Guilbert** et **Cimbert**. Sur la signification réelle et la précision des mensurations de profondeur que fournissent les procédés radioscopiques et radiographiques. [**The accuracy of measurements of depth in radiography.**] *J. de radiol. et d'électrol.*, 1919, **3**, 316.

The authors show that in the method of localization by triangulation, when the foreign body is of appreciable size, the two points taken on the contours of the two images corresponding to the two positions of the tube are not, in general, strictly homologous. This method of localization yields only a mean value of the depth of the foreign body, which is, however, sufficient in most cases. The most correct results are obtained when the two positions of the tube are on the same side of the normal to the plate, through the splinter. J. R. C.

**Pérol, P.** et **Bazin, G.** Quelques points de pratique et quelques résultats de la méthode Belot-Fraudet sur la localisation des corps étrangers intraoculaires. [**The technique of the Belot-Fraudet method of localization.**] *J. de radiol. et d'électrol.*, 1919, **3**, 303.

As a radiograph is always necessary, the authors have abandoned the preliminary screen examination, but employ it, after a photograph has revealed the presence of a foreign body, to ascertain whether this is palpebral, intra- or extra-orbitary. To determine the axes of the eye in the lateral radiograph, they find the position of the projections of two points on the antero-posterior axis. One of these is the centre of the pupil when the eye is looking straight forward, and the other is the centre of the eye. The former is found by placing a needle point or cross-wires as near to the pupil as possible when the radiograph is taken. The later is fixed by trial instead of by the complicated method given by B. and F. The perpendicular to the antero-posterior axis, through the centre of the eye gives the vertical axis. When the frontal radiograph is taken, the patient being supine, one of two right-angled cross-wires is placed as near as possible to the eye, the other is placed 12 cm. above it, and the crosses and the centre of the pupil are aligned. One wire in each case is prolonged in front of the eye not under examination, and when these are superposed on the centre of the pupil of this eye, they give the direction of the lateral axis. The shorter wires of the cross are then parallel to the vertical axis. In all the radiographs, instead of using fixed metallic points, which may be displaced by involuntary movements of the head, for reference, bone contours are employed. It is shown that in this case a slight movement is immaterial, the error in localization being about 0·5 mm. for a movement of 5 cm.

The authors have effected 82 localizations by the B.-F. method, which they regard as accurate and sensitive. J. R. C.

**FRAUDET, H.** Localisation des corps étrangers du globe oculaire par la méthode Belot-Fraudet. [**The Belot-Fraudet method of localization.**] *J. de radiol. et d'électrol.*, 1919, **3**, 310.

In order to be sure that a foreign body is intra-ocular it is necessary to verify that it is carried by the eye in all its movements. The author describes a geometrical construction, for the purpose of this verification, which also fixes, by trial, the position of the centre of the eye. It is very similar to the one employed for this latter purpose by Pérol and Bazin (see previous abstract). In practice, it is inconvenient to have to make a separate construction for every case, so one construction is made to serve for all cases, the rotations of the eyeball when the radiographs are taken being standarized. J. R. C.

**WINTZ.** Die Gasvergiftung im Röntgenzimmer. [**Gas poisoning in the X-ray room.**] *München. med. Wchnschr.*, 1918, **11**. (*Centralbl. f. Chir.*, 1919, **46**, 142.)

Poisonous gases are produced both during silent discharges of a high tension current and during the actual sparking. The real injurious agents are ozone and its organic derivatives which lead to chronic poisoning (headache, lassitude, diminished mental activity, changes in the blood). Therefore, when the rays are being produced in large quantities the use of ventilating fans is desirable. S. L.-B.

## *Radiography*

**PAUCHET, V.** Pathogénie de la stase intestinale chronique (Maladie d'Arbuthnot Lane). [**The pathology of chronic intestinal stasis.**] *Presse méd.*, 1919, 24 March, 151. (*J. de radiol. et d'électrol.*, 1919, **3**, 278.)

This condition is common enough, but is often unrecognized, and for its diagnosis X-ray examination is most important.

Its causes are both mechanical and physiological.

The passage of food along the alimentary canal is normally rapid—the food reaching the caecum in 4½ hours, hepatic flexure in 6½ hours, splenic flexure in 9 hours. and pelvic colon in 11 hours. The author studies the function of the small and the large intestines separately.

There is a normal ileal stasis. To distinguish ileal stasis secondary to caecal trouble, the opaque meal should be given 36 hours after the taking of an aperient, with an enema on the morning of the meal. The ileum is protected against overloading by a gastro-duodenal reflex. When a normal meal is given, the stomach is found to pass its contents rapidly into the intestine, but when the ileum is reached, this passage is checked.

Sphincteric zones are present at (1) the third portion of the duodenum, (2) the terminal ileum, (3) the right half of the transverse colon, (4) the junction of the sigmoid and the rectum. They are recognizable in the neighbourhood of the hepatic and splenic flexures. By radioscopy the intestine is seen to have the form of a sausage, a contraction takes place and the contents move *en bloc* towards the rectum.

The author concludes by saying that it is not by a plate but by a series of three or four screenings that the diagnosis of chronic intestinal stasis is established. R. W. A. S.

**Dufour, Paul** et **Pierre.** Étude de l'influence de la pneumatose du gros intestin sur l'image radioscopique de l'estomac. [**The effect of gaseous distension of the large intestine on the radioscopic outline of the stomach.**] *Arch. d'électric. méd. et physiothérap.*, 1919, **27**, 225–9.

These authors describe the case of a stomach pushed over to the right side of the abdomen under the liver and with a marked indentation on the middle of the greater curvature, giving a bilocular appearance, due to distension of the splenic flexure with gas. On repeating the examination some days later, the position and outline of the stomach was seen to be normal.

Experimentally the authors have reproduced these appearances from slight indentations of the greater curvature simulating spasm from ulcer to complete biloculation of the stomach. R. W. A. S.

**Breccia, G.** Hypocapacité respiratoire du sommet sans manifestation de localisation tuberculeuse. [**Diminished capacity at the apex without localizing tubercular signs.**] *Presse méd.*, 1918, 9 Dec., 629. (*J. de radiol. et d'électrol*, 1919, **3**, 280.)

After studying several thousands of cases, the author draws attention to a syndrome which causes a *locus minoris resistentiae*, and consists in a diminution of respiratory capacity at the apex.

It can arise from (1) non-tuberculous condensation at the apex, (2) pleuro-thoracic lesion from various causes, (3) skeletal deformity.

Radiologically, whilst tuberculosis at the start shows opaque nodules and lymphatic shadows, diminished respiratory capacity shows a lessened translucency at both apices alike. There is less expansion, but no true opacity or modification of lung density. R. W. A. S.

## *Radio-diagnosis*

**Meyer-Hurliman.** Röntgenologische Beobachtungen. [**Radiological observations.**] *Cor.-Bl. f. schweiz. Ärzte*, 1918, **31**. (*Centralbl. f. Chir.*, 1919, **46**, 141.)

The author describes two cases of syringomyelia in which not, as is usual, only single regions of bone were diseased, but in which bone affections occurred fairly widely over the whole skeleton. Further, two patients suffering from scleroderma were examined radiologically. Marked atrophic and destructive bone processes were found in the hands, along with extensive infiltration by calcium salts in the soft parts. He includes 16 excellent radiographs showing clearly the very marked typical changes.

S. L.-B.

**Reiche.** Eine (diphtheritische?) Schlinglähmung im Röntgenbild. [**Diphtheritic paralysis.**] *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1918, **25**, 4. (*Centralbl. f. Chir.*, 1919, **46**, 143.)

The radiograph showed, after a swallowing experiment, a tubular effusion involving the whole trachea and the large bronchi; also in both the lower lobes of the lungs the larger and smaller bronchi were filled with contrast-fluid. Clearly the case was one of diphtheritic paralysis, with an unusually great diminution of reflex-excitability in the larynx and trachea.

S. L.-B.

**Wertheimer.** Fremde Körperbestimmung mittels Präzisions-Röntgensdurchleuchtung. [**Localization of foreign bodies.**] *München. med. Wchnschr.*, 1911, **14**. (*Centralbl. f. Chir.*, 1919, **46**, 141.)

The author states that the new Rosenthal tube for precise irradiation has proved to be the best for use in the exact localization of large foreign bodies as well as for improving the sharpness of the radiographs of small splinters. The edges of the diaphragm give clear definition, so that the Holzknecht-Sommer-Meyer method with the new tube gives the sharpest results.

S. L.-B.

**Spriggs.** **The examination of the vermiform appendix by X-rays.** *Arch. Radiol. & Electroth.*, 1919, **23**, 301.

This paper is the result of a careful examination of radiographs of about 300 appendices, normal and pathological, and is well illustrated. An important feature is the tabulation of 36 cases, in which the radiographic and operative findings are compared. It was found, following George and Leonard, that an opaque meal of bismuth and buttermilk was far better than one composed of porridge or other material of greater consistency than buttermilk. Castor oil, too, should be administered 36 hours before giving the opaque meal. S. says that now he is able to see the appendix in the majority of cases, though examination is necessary in many positions at times. If the caecum lie in the pelvis it is necessary to withdraw it by appropriate manipulations, details of which are given in the paper. As a rule, it is best visible about 12 to 14 hours after administration of the opaque meal, but the time naturally depends upon the rapidity with which it leaves the stomach and passes along the upper intestine. Variations in the appearances presented by normal appendices and features indicative of pathological conditions are given. Amongst the latter, S. lays stress upon a 'hooked' shadow and an absence of mobility under manipulation. In determining whether an appendix is, or has been diseased, attention must be paid to filling and emptying, shape, mobility, position, and the presence of concretions, hyperactivity, spasm, or tenderness. Each of these criteria is considered in a short paragraph. The paper is balanced and practical.

W. S. L.-B.

## *Radio-Biology*

**Zimmern, A.** La radio-sensibilité des glandes à sécrétion interne. Application à la surrénale. [**The sensibility of the glands of internal secretion to radiation. Irradiation of the suprarenals.**] *Bull. Acad. de méd.*, 1919, **23**, (*Arch. d'électric. méd. et physiothérap.*, 1919, **27**, 248.)

In radio-biology, when we wish to show the selective action of X-rays we usually choose, as an example, one of the glands of external secretion, making the observation that in a gland of internal secretion, if the seminal or ovarian epithelium is affected the interstitial cells are spared.

It must not be inferred, however, that the glands of internal secretion escape the action of the rays. Their structural elements are susceptible in the same way as are all living tissues, but their sensitiveness to rays of very short wave-length is much below that of the glands of external secretion.

We have, as yet, only a vague idea of the relative sensibility of the various glands of internal secretion—reproductive glands, thymus, pituitary, and suprarenals. But of this we are certain, that the normal elements of these glands can be profoundly affected when submitted to the rays in sufficient dosage. The author has been able, with Battez, by raying the exposed thyroid in rabbits, to produce symptoms similar to those seen after removal of the gland. In the same way, Régaud and Crémieux have caused a definite melting away of the thymus by means of intensive doses.

A fact which appears to be established with more and more certainty is that the susceptibility of the glands of internal secretion increases when they have undergone a pathological process, not necessarily malignant. For example, hypertrophy of the thymus in children (Friedländer, Myers, &c.) and gigantism (Béclère) can be quoted as conditions in which radiotherapy has a certain number of successes.

The suprarenal gland is no exception to the rule, and if radiologists have rather neglected this field of research, it is because this gland has appeared difficult to approach by reason of its depth and because its proximity to the kidney has raised a natural apprehension in their minds.

By means, however, of a careful localization of the beam of rays, the author has been able to irradiate the suprarenal gland sufficiently to observe histological changes in animals, and functional changes in man, without any damage to skin or kidney.

Experimentally in dogs, the normal suprarenal after sufficient irradiation shows changes in the cortex. There is a remarkable change in the cells of the zona fasciculata, it is a little less marked in the zona reticularis, while there is little or no change in the zona glomerulosa.

In the human being, giving less dosage, the author has only treated suprarenals showing an excess of function, i.e. patients with constant hyper-arterial blood-pressure, and the general idea of the reducing influence of the rays should lead us, *a priori*, to positive results.

The lowering of the arterial pressure appears from forty-eight hours to six days after the application and is a constant result. It only varies between one patient and another in its degree. In the author's experience, this diminution has been from two to six centimetres on an average, while in two cases there was a drop of seven and eight centimetres in the systolic pressure. The duration of this varies in different individuals, but the author has seen it last for several months. R. W. A. S.

**Lewin, I.** and **Lewin, M.** The biological and clinical evidence of the therapeutic value of radium and Röntgen rays in cancer. [**The therapeutic value of radium and Röntgen rays in cancer.**] *Ann. Surg.*, 1918, **4**. (*Centralbl. f. Chir.*, 1919, **46**, 144.)

From an experiment with *B. tumefaciens* on plants (formation of tumours, crown-galls), the conclusion was arrived at that the tumour cells were not killed, but that by means of X-rays their power of reproduction was destroyed. Thus, microscopically, X-rayed growths have the same appearance as those which have not been X-rayed, but the cells of the former are sterile. Malignant tumours in man, therefore, should not only be treated with X-rays after an operation, but in certain cases before, thereby rendering the tumour sterile. S. L.-B.

**Ghilarducci, F.** Intorno ad alcune vedute moderne sull' azione bio-fisica dei raggi X. [**Concerning some modern views on the bio-physical action of X-rays.**] *Radiol. med.*, 1919, **6**, 153–205.

The author describes in full detail, and with beautiful reproductions of sections, the results of a series of experiments on the action of X-rays on the stomach of the rabbit. In the main experiment the animals were subjected to irradiation after a bismuth meal had been inserted into the stomach. For controls some were irradiated without bismuth, some had bismuth without irradiation. The region showing macroscopic evidence of change was examined microscopically in all cases, and the whole gastric region was thus examined in many cases. The results are shown in three classes, according to the thickness of filter —1 mm., —3 mm., and —4 mm., while each class has subdivisions for the various degrees of hardness of rays used: this system corresponds to the types of alteration found.

The first control, bismuth only, proved that this substance was well tolerated by the gastric mucosa, and caused no appreciable alteration.

The cases irradiated without bismuth showed less severe change than those forming the main experiment; in these the bismuth provided a source of secondary rays to re-inforce the action of the primary ones. Discussing which of Barkla's three categories of secondary rays are concerned in this action, the author considers that the second category or fluorescent and the third or $\beta$ group are responsible. The former are hard enough to penetrate to the muscular coat, and produce the destructive lesion or perforating ulcer, the latter account for the necrotic and inflammatory results which were seen over a wide area of injury.

The pathogenesis of the lesion has been questioned, but the evidence of these experiments is against the nervous system theory, and entirely in favour of direct action on the cells affected.

The softer rays, 9 to 10 *Wh*, had a weak and inconstant action, even in high doses, and mainly in the direction of inflammation and distrophy. Harder rays, 10 to 12·5 *Wh*, were less inflammatory and more necrotic. The lesions were relatively superficial but extensive. The very hard rays, 13·5 to 14 *Wh*, had no inflammatory action, but were distrophic and elective (atrophy of epithelial cells), or profoundly destructive (perforating ulcer). In this case the action was very circumscribed. When double irradiation was given, mixed effects were seen, the result being additive. Two softer doses seem to add their effects and to be equivalent to one harder dose. In practice the author has found as good results with a single dose of hard rays for fibromyoma, as formerly he got with two doses of softer rays.

The action of filters was to cut off inflammatory and necrotic rays. This modification of quality could not be appreciated by ordinary qualimetric devices, and apparently identical irradiations produced different results. This is a proof that the histological elements are more sensitive to the rays than are the purely physical elements. Hence the author's main contention that the biological action of rays is in relation to their quality, as well as to the quantity of rays absorbed, and that there is a strict relationship between wave length and biological action, based on this principle of quality rather than quantity. Purely physical methods being inadequate, they must be replaced by bio-physical means of measurement, for which the biological unit remains to be found. The criteria for establishing this unit must be deduced from (1) the distrophic and elective action, and (2) the inflammatory and necrotic action of the rays. He criticizes the methods previously suggested, including that recently described by Russ, and thinks that a basis for this work is better provided by the series of experiments described. N. B.

## *Electrotherapy*

**Titus, E. C.** and **Kraft, F. de. The use of high frequency electrica lcurrents (diathermy and auto-condensation of D'Arsonval) as an adjunct in the treatment of syphilis.** *Am. J. Electrotherap. & Radiol.*, 1919, **37**, 31–9.

Diathermy and auto-condensation induce a heating of all the tissues, followed by active hyperaemia, stimulation of metabolism, and increased elimination by skin, urine, and lungs. These conditions are conducive to the absorption of inflammatory deposits, and can be utilized in promoting the absorption of new syphilitic formations. On this argument the authors base their claim that these forms of electricity can often be of great help in the treatment of syphilitic conditions. The action helps that of arsenic, mercury, and the iodides on the lesions themselves, and the increased elimination prevents the appearance of the toxic effects of the drugs. They describe with detailed explanations of method their treatment of many cases, and show that larger doses of the ordinary anti-syphilitic drugs can be tolerated when aided by general high frequency and by local effleuves and by diathermy, and how good are the results of these combined efforts. Th method must be chosen for each case, by skill based on experience, which is also much needed for controlling the dosage. This should in general begin low and work up by degrees. Static treatments have also given good results.

Dr. W. Benham Snow gave approval to the auth rs' claims, and described the striking cessation of symptoms in two resistant-cases of tabes under static wave-currents.

Dr. J. B. Burch confirmed the value of electrical treatments as complementary to drugs.

Dr. V. C. Kinney brought additional evidence of the value of static and high frequency treatments in combination with the ordinary methods.

N. B.

# MEDICAL SCIENCE
## ABSTRACTS & REVIEWS

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# REVIEWS

## TUBERCULOSIS

**Classification and nomenclature.** A satisfactory classification and nomenclature for pulmonary tuberculosis would conduce greatly to clear thinking about the disease, but owing to the variety of the clinical and pathological features at various stages, it is most difficult to make subheadings mutually exclusive, and almost impossible to employ more than one basis of classification. Hence a division into stages based on several factors like the well-known Turban-Gerhardt classification comes to mean little more than slight, moderate and advanced cases.

After a short review of recent work (Nicol, Aschoff, Ribbert, Bacmeister) Paweletz evolves the following schema on the basis of morbid anatomy:—

| | Progressive | Stationary | Inactive | Secondary Changes |
|---|---|---|---|---|
| Tuberculosis productiva | miliaris | indurativa | Tuberculosis cirrhotica | Tuberculosis cirrhotica-bronchiectatica |
| | ulcerosa<br>cavernosa<br>(ulcero-cavernosa) | indurativa | | |
| Tuberculosis exsudativa-caseosa | miliaris | indurativa | | |
| | ulcerosa<br>cavernosa<br>(ulcero-cavernosa) | indurativa | | |

But while employing such a scheme of pathological diagnosis, the author is willing to supplement it by the following terms: clinically, active and inactive, with sub-divisions of slight, moderate and severe; from the point of view of progress, improved, stationary, worse; and economically, capable, partially capable, or incapable of work.

**Experimental work.** Long has attempted to find out in what way the utilization of amino acids and ammonium salts by tubercle bacilli growing on nutrient media is related to the protein metabolism of the organism. Following the accumulation of evidence that the amino acid is not the last stage in the break-down of a protein before re-synthesis, it becomes necessary to study the course of deaminization, and the subsequent re-combination of the ammonia and other products to form the body proteins of the bacillus. Such amino acid catabolism could occur in several different ways. By artificially imitating these ways, and by seeing which of the products were most readily utilizable as judged by growth, the author attempted to discover the modifications produced by the bacillus itself. Further, in order to permit of the simultaneous study of peptone hydrolysis, peptic and tryptic digests of casein were employed with glycerol, as the basis of experimental media. Nitrogen analyses of inoculated peptone media showed withdrawal of both peptone and amino acid nitrogen with production of ammonia. Nitrogen metabolism was also followed in growth on asparagin media, and the amide group was found to be chiefly attacked. A reaction of $P_H$ 6·8 was chosen for the synthetic media.

The experiments indicated that the tubercle bacillus hydrolyzes proteoses and peptones with formation of amino acids, and deaminizes the latter. The course of this deaminization is suggested by the ready utilization of amines, alcohols, and of ammonium salts of dibasic acids, monobasic acids (which appear to be inhibitory) not being formed. It is suggested that glycine and alanine break up into ammonia and alcohols (perhaps through amines), that hydroxymalonic acid is formed in the medium through oxidation of glycerol, and that ammonium malonate and malonic ester are of great importance in synthesis.

The employment of cultures of tubercle bacilli of diminished but constant virulence, such as the R1 strain of Trudeau, which was produced by long incubator existence, has enabled disease to be produced in guinea-pigs more or less comparable in relative chronicity to human tuberculosis. During the observation of pigs which had received single inoculations of R1, and which had shown disease limited to the lymphatic gland system over periods running into years, Krause was much struck by the fact that examination of the tracheo-bronchial nodes always revealed marked disease, in spite of the fact that no trace of change could be found in the lungs.

The presumption is strong that the same sequence occurs in human beings, and Krause combats the theory advanced by Ghon of the priority of pulmonary *lesion*, as opposed to pulmonary infection or passage. The tracheo-bronchial nodes are in fact the converging point of the lymphatic system of the lung, and bacilli brought by air or by the blood-stream, can pass to the nodes without leaving a lesion behind them. Indeed, every facility is offered to foreign particles gaining the lung by any route whatever, to proceed to the nodes. Since the lungs in turn comb out the blood-vascular circulation, the nodes evidently occupy an unique position.

Many of the pigs showed lesions in the nodes which appeared to be older than anything to be found in the region of the site of inoculation, and the author remarks on the uncertainty attending attempts to determine by inspection the relative age of lesions, or to found any theory thereon, especially when two different tissues are in question.

The factors determining the localization of tubercle in particular organs, whether anatomical or biochemical in nature, are at present very obscure, and will remain so until comparative pathology supplements anatomy in telling us the difference between the same viscera in man and the various experimental animals. But on grounds of situation and of the facilities for numerical concentration alone, the present work helps to explain why tubercle is limited to the lymphatic system in the animal inoculated with bacilli of low virulence. In the lymph nodes bacilli tend to accumulate sufficiently to cause lesion, while only massive dosage will cause direct visceral involvement.

Krause and Willis report further attempts to influence present and future tuberculous infection in the experimental animal by the injection of proteins. The proteins used were egg-white and tuberculo-protein in the form of a water extract of dried pulverized tubercle bacilli, and groups of guinea-pigs were treated, some before and some after infection with living bacilli, which they received along with control animals. In one series the infecting strain was of high virulence, in another it was the attenuated 'R1' strain.

It was found that repeated injections of egg-white do not influence an established infection, even though the animals be kept in a state of repeated anaphylactic shock. Injection of either protein probably renders guinea-pigs less resistant to subsequent infection.

The authors discuss the significance of the fact that any protein product of tubercle bacilli can elicit cutaneous reaction in the tuberculous animal, but that an animal can only be rendered skin-sensitive in this way by infection with intact bacilli. During the preliminary treatment with tuberculo-protein they took the opportunity of testing the skin-sensitiveness of the uninfected pigs; in every case with a negative result. The infected pigs, on the contrary, never lost their positive reaction. There is, therefore, no cutaneous hypersensitiveness to tuberculin without tubercle.

The work bears an important relation to the development of tuberculous metastasis after acute fevers with or without exanthemata, in which protein intoxication is suspect.

Karczag describes a lengthy series of experiments made under Korányi's direction on the artificial modification of tuberculous allergy in the guinea-pig and in man by various artificial means. Römer's intracutaneous tuberculin reaction was employed to follow the changes in allergy, but as this only appears three weeks after infection in the guinea-pig, graphic records were made of the size and development of regional glands, in order to form some idea of the capacity for reaction during the initial period. Large series of animals were employed, generally 2–3 months old, and the infecting dose was ·005 to ·008 mgm. of virulent human bacilli given in ½ c.c.

Confirming Römer's observation the author finds higher allergy in albinos than in coloured pigs during the early stages, but this gradually diminishes while that of the coloured pigs increases. The albinos show larger glands, and healing is more rapid, but the general mortality is higher. Pigs kept in the light show higher and more persistent allergy than those kept in the dark. Starved animals show smaller gland swellings and lower skin reactivity than well-fed ones, but fluctuations in weight do not in general run parallel with allergy. The onset of the local phenomena of infection gives no constant indication of the development of allergy. During pregnancy a steady level is maintained, but after parturition there is a heavy fall. Thyroid extract raises allergy, as do small doses of benzol.

In the human experiments, early cases free from previous tuberculin treatment were found most suitable. Age and duration of disease *per se* appeared to have little effect, but cases with T. B. plus showed lower reactivity than cases as yet closed, and those treated with tuberculin lower than those untreated. Again, small doses of benzol raised allergy as did iodide of potassium and thyroid. Ten to fourteen days before menstruation it is at its lowest. Anti-typhoid inoculation depressed it considerably, small-pox inoculation appeared to raise it. Total figures gave 94 per cent. positive to the reaction, and of the positives graded according to the severity of reaction—61 per cent. were moderately allergic, 26 per per cent. hypallergic, and 13 per cent. hyperallergic.

The paper concludes with a study in experimental pellagra induced by maize feeding. This was suggested by the rarity of tuberculosis as a complication of clinical pellagra. Animals, in which experimental pellagra had been induced, showed less marked local changes to tuberculous infection and also depressed skin reactivity. The author recognizes the animal disease as an acute intoxication, and clinical pellagra as a chronic form distinct in many of its features. A constant finding in the guinea-pigs was suprarenal haemorrhage, and the chromaffin system appears to play an important part. The author made experiments with animals kept in light and darkness, as a result of which he combats the photo-dynamic theory. He thinks that infection probably plays a part in the animal disease. He concludes that the immunity against tuberculosis in human pellagra is only apparent, and due to the weeding out of cases who have succumbed early to the combined diseases.

**Morbid anatomy.** In an exhaustive anatomical study, Miller (1) has attempted to reconstruct by means of a model the spatial relations of a tubercle in the human lung. The tubercle had an average diameter of 2 mm., and appeared in 76 serial sections. The main features of each of these were cut out in greatly magnified dimensions on a wax plate, and all the plates were then superimposed to form a solid model, the features of which are illustrated in the paper by means of stereoscopic diagrams.

The tubercle was conglomerate in type, and the central portion of each part was caseous. The area of reaction was extending to include not only adjoining air-spaces, but also branches of the pulmonary vein and artery. The tubercle was not limited to any single system of air-spaces. It was between two bronchioles, and involved the respiratory bronchioles, alveolar ducts, atria, saccules, and alveoli proceeding from both of them. Partial collapse of the larger branches of the pulmonary vein in the area appeared to be due to thrombosis. Considerable deformity of the air-spaces, caused by pressure of the tubercle, made identification difficult. The study is preceded by a valuable summary of the normal lung structure.

In a subsequent paper Miller (2) gives a short account of the previous work on the anatomy of the pleuro-pulmonary lymphatic system, and proceeds to describe the arrangement of the lymphatics accompanying the bronchi and the branches of the pulmonary veins and artery in the human lung.

The larger bronchi have two sets of lymphatics which enclose the cartilages; the smaller bronchi and subsequent divisions only one. No lymphatics are present in the walls of the air-spaces distal to the ductuli alveolares. The bronchial and the arterial lymphatics are closely situated, and they communicate at the bronchial divisions, and at the distal end of the ductuli alveolares.

The pulmonary veins arise from the pleura, sacculi alveolares, distal end of the ductuli, and from the bronchial divisions. Lymphatics accompany the veins from all these points excepting those from the sacculi, in the walls of which there are no lymphatics. At the place where the venous lymphatics join the pleural lymphatics, valves are present; but the lung lymphatics are as a rule destitute of valves. No lymphatics unconnected with lymph nodes have been seen leaving the lung.

There is a single plexus of lymphatics in the pleura, of which the larger vessels form irregular polyhedral rings marking out the secondary lobules. The branch of the pulmonary vein that takes its origin from the pleura passes into the interlobular septum. A single lymphatic runs with this vein, and it is this vessel which connects the lymphatics of the lung and pleura. It has valves which point towards the pleura.

Under normal conditions drainage in the lung is towards the hilus, and the large lymphatic trunks round the pulmonary veins at the hilus, have valves pointing in that direction. But, if this be prevented, the flow is into the pleural vessels. The paper contains photographs of sections showing the working of this mechanism, and the dilatation of lymphatics due to obstruction by tuberculous disease.

In a series of exhaustive post-mortem studies, in collaboration with Pototschnig, Ghon discusses adult tuberculous infection in relation to the whole question of endogenous re-infection, and develops further his views on the primary lung focus. The findings in several cases were indicative of definite late adult infection, showing a primary complex similar to that which the author recognizes as the result of primary lung lesion in children. Such cases of late infection are, however, comparatively rare, and the great majority of healed or latent lesions in adults are to be recognized as the result of juvenile infection.

Theoretically, the distinction between exogenous and endogenous re-infection is sharp enough, and closely related to questions of general policy in tuberculosis, but in practice it is most difficult to establish. The authors produce a series of adult post-mortem findings illustrative of endogenous re-infection from glands affected secondarily to an old primary lung focus. Passing by the lymph chain back through the venous blood, the infection re-establishes a focus in the lung, and this would appear to be the common sequence. The course of infection through the various gland groups is most intricately followed, though the notorious difficulty in determining the relative age of lesions in lung and gland tissue makes the task a formidable one.

Some years ago, sundry authors (Dominici, Achard, Weil) described a 'myeloid reaction' which took place in the spleen of the guinea-pig as the result of tuberculous infection. Weill describes the results of a careful histological study of the same phenomenon. At the margin of a caseous tubercle, corresponding frequently with the zone where a Malpighian corpuscle passes over into the red pulp, a cellular reaction is observed. In contrast to the normal spleen the leucocytes are mostly of the granular myeloid series. Eosinophils lie singly and in groups, and show by the shape of their nucleus and other characteristics every form from the 'large lymphocyte' (myeloblast) through the myelocyte series down to the mature cell. Pseudo-eosinophils are to be seen, mostly with kidney-shaped nuclei. Mitosis is frequent. Cells with basophil granulation are present in fair number, the majority belonging to the mast-leucocyte series rather than to the histogenous mast-cells. For the most part their nuclei are two- or three-lobed, but myelocytic forms are also present. The lymphocyte series remains in the background. Some typical 'large lymphocytes' are to be seen, but the so-called 'Kurloff's corpuscles' and plasma cells are conspicuous by their absence. In the red series, erythroblasts in all stages are observed, including the polychrome forms.

Weill does not doubt that this is a true local metaplasia and not the result of exogenous production of red or white cell precursors. The reaction is probably not specifically tuberculous, and is possibly called forth by anaemia. It appears that the tuberculous human spleen shows no parallel reaction, but further work is needed on this point. It cannot be said that we have as yet any very clear idea as to the importance of the reaction of the blood-forming organs to tuberculous infection. In view of the importance attached to the lymphocyte series by American experiments on the mouse, studies of this type are very welcome.

**Symptomatology.** The nucleus of Pfeiffer's paper is a tabular presentation from the literature of cases showing urgent symptoms of stenosis of the air-passages due to pressure or perforation by tuberculous glands. It embraces both the pre- and post-endoscopic periods, and two cases of the author's are included. It seems quite clear that cases treated by simple tracheotomy when the symptoms become urgent, show a heavy mortality, and the author pleads the advantages of low bronchoscopy both for accurate diagnosis of the condition present and also for measures of relief.

He deals at length with the bronchoscopic picture in stenosis caused by the various groups of glands. The trouble is more frequently on the right side, and it is generally possible to detect the site of a perforation. These are generally quite small at first. Mechanical pneumatic suction and forceps are among the means employed to remove débris in the air-passages, and the author also suggests the use of a form of elastic cannula. He reviews the symptomatology of tuberculous bronchial glands, especially with regard to pressure effects, and discusses the numerous methods of physical examination, including the X-ray phenomena, with special reference to the differential diagnosis of foreign bodies, thymus enlargement and gland swellings of different origin.

At present the operative removal of gland masses by any form of mediastinotomy remains a formidable proceeding, hence bronchoscopy deserves careful use. Pfeiffer does not attempt high bronchoscopy in children under about five years, nor in cases where repeated operation is probable, e.g. where perforation has occurred.

Simon calls attention to a difficulty in the diagnosis of short febrile illnesses in children who are the subjects of hilus tuberculosis. Many such bouts are intercurrent pneumococcus infections. In the mildest of these there is nothing to be observed except rise of temperature and a little intrascapular dullness and bronchial breathing, with perhaps a few crepitations and extended X-ray hilus shadow. The signs may extend more or less into the upper or lower lobe, but in a few weeks everything has disappeared, while the acute symptoms are over in as many days.

More severe cases occur with pneumonic signs and more serious prostration, and the diagnosis is likely to be either tuberculous pneumonia, or ordinary pneumonia of central type; but the first is excluded by the comparatively rapid return to the *status quo ante* and the latter by the absence of a typical course, for the condition in question shows neither rigor, crisis, or rusty sputum, nor any considerable acceleration of pulse or breathing. The sputum however shows pneumococci, and these the author regards as causative. In any case it would appear that the condition is a distinct clinical entity.

Burnand describes an **undulatory form of tuberculous fever** characterized by the appearance on the temperature chart of undulatory pyrexial relapses of almost equal duration (8–15 days) and intensity. Each pyrexial wave is separated from the following by a more or less marked phase of defervescence. This type of fever is very frequent, as Burnand has collected 72 cases which he classifies in the following three groups: (1) a febrile type in which the temperature exceeds 100·4 and may rise to 102·2 or 104°. Of the 39 cases in this group, 14 presented recent caseous phthisis or rapidly developing fibro-caseous tuberculosis, 6 showed caseous phthisis with discrete or confluent foci (caseous broncho-pneumonia), 17 were examples of chronic ulcero-fibrotic tuberculosis and 2 had acute miliary tuberculosis complicating chronic disease. (2) A sub-febrile type in which the maximum temperature did not exceed 100·4. Of the 23 cases in this group 6 died, 7 made a relative recovery, and the 10 remaining patients showed either a chronic fibro-caseous lesion subject to indefinite relapses or disseminated tuberculous lesions of uncertain localization, which were apparently mild but very persistent. (3) A type characterized by physiological undulations, the maximum temperature in the mouth hardly ever exceeding 99·6. In 10 cases of this group the patients showed signs of chronic tuberculous infection which sometimes cleared up under the influence of climate or tuberculin but frequently resisted any form of treatment. In the first type the tuberculous infection is extremely virulent, giving rise to severe and rapidly spreading lesions of the lung substance which are almost always associated with tuberculous septicaemia. The prognosis in such cases is hopeless. In the subfebrile types the disease is less virulent and the patient has more power of resistance. The immediate prognosis is less gloomy, but the evolution of the cases is similar to those of the first type. The third type indicates a much milder but equally diffuse tuberculous process. Burnand concludes that the characteristic features of the undulatory type of fever are (1) persistence of the infection which is favoured by inadequate means of defence on the part of the organism; (2) diffuse and septicaemic character of the tuberculous lesions.

In his thesis on **traumatic pulmonary tuberculosis** Euthymiou states that up to 1914 statistics of traumatic tuberculosis only applied to extra-pulmonary lesions, especially disease of the joints and vertebrae. Since the war, however, several writers have published statistics relating to tuberculosis of the lungs following trauma. In 30 cases of thoracic trauma such as fracture of the ribs and contusions, Brouardel and Giroux found only two cases in which the injury appeared to have really caused the development of pulmonary tuberculosis. In 96 cases of thoracic trauma (penetrating wounds and contusions) Sergent found nine cases. Denéchau noted a percentage of eight. As regards the influence of penetrating wounds only, Bernard and Mantoux in 379 cases with chest wounds found five with open and five with closed tuberculosis. All writers are agreed that contusions are an exciting cause of tuberculosis. In 49 cases of contusion observed by Bernard and Mantoux there were three cases of pulmonary tuberculosis—a proportion of more than 6 per cent. As regards asphyxiating gases, Gimbert in one set of statistics reported a frequency of pulmonary tuberculosis in 3 per cent., and in another set one of 2·4 per cent. Euthymiou examined the records of 737 soldiers at the Lyons Tuberculosis Dispensary who had been discharged from the army for pulmonary tuberculosis and found that in 9 cases tuberculosis followed gas-poisoning, in 2 contusions, and in 2 penetrating bullet and shell wounds. He records the histories of 28 cases, in 4 of which pulmonary tuberculosis followed penetrating wounds of the thorax, in 2 commotion, in 2 contusion and in 20 asphyxiating gas. In 14 of the 28 cases there was no personal or family history of tuberculosis or of any predisposing factor such as alcoholism or an acute infection, especially measles, influenza, or whooping cough. In the other 14 cases the existence of previous tuberculosis was probable. Apart from its aetiology there is nothing to distinguish post-traumatic tuberculosis either clinically or anatomically from the various forms of pulmonary tuberculosis due to other causes. In its mode of evolution, however, it has a tendency to assume three fairly distinct forms: (1) The most frequent is indistinguishable from the ordinary fibro-caseous form. (2) An acute or sub-acute form. (3) An abortive form ending within a few months in apparent return to health and disappearance of the local signs. Tuberculosis following gas-poisoning presents at first much congestion and haemoptysis and is afterwards characterized either by progressive extension of the lesions or by a rapidly abortive course ending in recovery. The diagnosis between bronchitis and tuberculosis following inhalation of gas is very difficult, and it may even be necessary to inoculate guinea-pigs to prove the existence of tuberculosis.

**Tuberculosis in asylums.** The increase in the incidence of pulmonary tuberculosis which has been pronounced during the last four years has been particularly characteristic of asylum patients. According to Elkins and Thomson the death rate from tuberculosis in a Metropolitan asylum in 1914 was 20 per 1,000, in 1915 34·2, in 1916 49·9, in 1917 72·6, and in 1918 117·6 per thousand. The high incidence and mortality from tuberculosis among the insane during the last few years are attributed to the following causes; (1) Lowered resistance to infection by the tubercle bacillus. The large majority of the patients admitted to the asylum were in very weak bodily health. (2) Contact infection which is chiefly due to contamination of hands, clothes, bed linen, &c., by infected excreta. (3) Reduction in fat and sugar in the diet. (4) Outbreaks of influenza and pneumonia. The diagnosis of pulmonary tuberculosis among the insane is a difficult matter, as in the great majority the classical symptoms of the disease are missing. Coughing is almost entirely absent, there is little or no sputum, and the temperature, though it sometimes shows the usual tuberculous type, is in many cases subnormal. The most frequent and reliable indication of tuberculosis among the insane is progressive loss of weight with progressive muscular asthenia. The onset of chronic diarrhoea is the next most important guide, and conclusive evidence will be afforded by the discovery of tubercle bacilli.

Winter has found that the **influence of pregnancy on tuberculosis** varies considerably. Examination of 29 women with latent tuberculosis by his assistant Sachse for six months after termination of pregnancy showed that in 82·6 per cent. no aggravation of the disease had been produced by pregnancy, but that the patients had improved after delivery had taken place normally. Pankow also found that in 29 women with latent tuberculosis 84·2 per cent. showed no aggravation of their disease as the result of pregnancy. Similar statements with regard to pregnancy and latent tuberculosis are made by other writers, so that it is generally agreed that abortion is contraindicated in latent tuberculosis. The prospect of the disease remaining stationary when the process is no longer latent is by no means so favourable. Sachse found that in 46 per cent. of such cases there was an aggravation of the disease, and that some of the cases died, especially those in which tuberculosis was advanced. In cases of active tuberculosis better results are obtained by performing sterilization at the same time as the induction of abortion than by the induction of abortion only. Winter, however, maintains that sterilization for progressive tuberculosis should only be carried out if fresh pregnancies are to be expected, and the conditions necessary for recovery are not available.

**Tuberculosis and influenza.** Permin observes that it is an old and familiar experience that influenza stirs latent tuberculosis into activity and favours the extension of already active disease. But figures showing the proportion of cases of phthisis suffering permanently from the effects of influenza have not hitherto been given. He has collected 45 cases of pulmonary tuberculosis complicated by influenza, and he classifies them according as the influenza was contracted in hospital or outside. He includes in this analysis 15 cases admitted to his tuberculosis hospital as a result of influenza (cases, presumably, of latent tuberculosis stirred to activity by influenza). Of the remaining 30 cases, 15 belonged to the third stage of the disease; in this stage death occurred in one case, the disease was aggravated in eight other cases. Out of 15 first or second stage cases, five showed progress of the disease in conjunction with the influenza. The writer seems to have found no great difference between the course of the influenza contracted outside or inside a hospital, but he notes with emphasis the fact that in no case did a patient who contracted influenza in hospital infect any of his fellow patients in the same ward.

Wurtzen deals with investigations made at the tuberculosis wing (180 beds) of the Öresund Hospital. Between July 1, 1918 and January 31, 1919, there were 97 cases of influenza among the patients. These cases included 58 men, 32 women, and 7 children. Of the 97 cases, only 30 represented infection in hospital, and this comparative immunity is traced by the writer to the open-air life, good hygienic conditions, and limited intercourse with the outer world. The immediate isolation of any of the staff exhibiting symptoms of influenza also contributed to the same result. Classifying his material according as his patients were in the first, second, and third stages of the disease, the writer shows that only five first stage cases contracted influenza, and only six in the second stage. In both these stages the influenza ran a mild course, and only one patient (in the second stage) contracted pneumonia. But among the third stage cases there were as many as ten deaths. Comparing the morbidity and mortality from influenzal pneumonia among the subjects of tuberculosis and healthy soldiers, the writer finds that the chances of a tuberculous patient and a healthy soldier contracting pneumonia as a sequel to influenza are practically the same (23 and 23·8 per cent.). But while 36 per cent. of the healthy soldiers with influenzal pneumonia die, the mortality from this complication among consumptives is as high as 83 per cent. Out of 48 cases of combined influenza and tuberculosis subsequently investigated, the tuberculosis was found to have progressed in 35 cases, and to have been unaffected by the influenza only in 13 cases. The writer has observed 26 cases in which the outbreak of tuberculosis coincided with the development of influenza. The subsequent course of the tuberculosis in most of these cases was exceptionally acute. Two died, one of miliary tuberculosis, and eight had already reached the third stage of the disease.

The stimulating action of influenza on tuberculous lesions which have long remained latent is illustrated by Bricaire who records ten illustrative cases. The re-activation of tuberculosis should be suspected when convalescence from influenza is protracted, an irregular fever appears, cough persists, expectoration becomes profuse, and the strength diminishes instead of returning. It should not be forgotten, however, that influenzal manifestations may simulate tuberculosis owing to their localization at the apices or to the occurrence of haemoptysis which frequently accompanies them. Diagnosis should be made by systematic examination of the sputum.

Some years ago, Von Pirquet called attention to the disappearance of the **cutaneous tuberculin reaction** in children during measles, a phenomenon which he described as ‘ anergy ’, or a failure to react allergically, and which he associated with the spread of a latent focus of tuberculosis. Bloomfield and Mateer are of opinion that reactivity is depressed and not entirely abolished in these cases.

During the recent epidemic of influenza, they took the opportunity of discovering whether anything similar occurred in other acute infections. Most of the cases were mild, and all recovered, so that the results were not complicated by terminal collapse, in which a similar depressed reactivity is sometimes found. Old tuberculin and the usual technique were employed, and tests were done both during and after the febrile stage.

Skin sensitiveness was found to be uniformly inhibited during the fever, but it returned in 89 per cent. of the patients during convalescence ; a proportion which conforms to the usual findings. It remains to be seen whether this result is to be regarded as due to any analogous features in measles and influenza, and their relation to tubercle, or whether it is a wider group-phenomenon common to febrile diseases, as recent German work which is quoted elsewhere would suggest.

Similar observations to those of Bloomfield and Mateer were made by Berliner, who found that von Pirquet’s reaction was positive in only 19 per cent of influenza patients, whereas in normal adults it was positive in 85 per cent. On recovery the reaction often became positive again. Different results, however, were obtained by Müller who made a similar examination of von Pirquet’s test in Eichhorst’s clinique at Zurich. Prior to the influenza period 500 patients, or 51 per cent., gave a positive reaction, 136 influenza patients were subsequently examined, and 60, or 44 per cent., were positive. On classifying these cases into influenzal pneumonia and uncomplicated influenza he found that the reaction was positive in 50 per cent. of the former and 33 per cent. of the latter. In other words, the proportion of the positive to negative reactions was the same in non-influenzal patients and in uncomplicated cases of influenza. Müller concludes that the influenza toxin as such has no influence on the result of the reaction, which is only affected by the general disturbance present in influenzal pneumonia. He also investigated the influence of temperature on the reaction, and found that in 92 cases whose temperature had been over 100·4 at the time of the reaction 40, or 43 per cent., were positive, and in 48 cases whose temperature was not above 100·4 20, or 45 per cent., were positive. The height of the fever therefore had no effect on the test. In 10 cases which had recovered from influenza Müller performed a second reaction about three weeks after the first and found only one positive case which had previously been negative. In all the other cases there was no change in the reaction. This examination also showed that the disappearance of the reaction is not characteristic of influenza. On the other hand the predisposition of influenzal cases to tuberculosis is a well proved fact. Müller concludes that there is no relation between a negative von Pirquet’s reaction and a predisposition to tuberculosis, and refers to the investigations of Jochmann and Rolly who found a high percentage of negative von

Pirquet reactions in cases of scarlet fever, a disease which does not predispose to tuberculosis.

Mayer has on previous occasions observed the absence of the cutaneous reaction to tuberculin during small-pox, cholera, and typhoid. During the war, he has had the opportunity of observing large numbers of anti-typhoid inoculations, and he finds that they produce inhibition of the reaction both in the clinically sound and also in the definitely tuberculous, who give a general response to tuberculin injections. The inhibition is found to go with a high agglutination titre to typhoid, and the reaction re-establishes itself as the titre falls again. The result is substantially the same if the cutaneous test is done with partial-antigens, though the degree and the duration of inhibition differ for the tuberculo-protein, lipoid-fatty acid, and neutral fat components.

The general reaction to tuberculin is not found to be in any way affected, nor is any bad effect of inoculation on early cases of tuberculosis to be observed, and the author is of opinion that cutaneous super-sensitiveness and the general state of immunity of the body against tubercle are not parallel phenomena. He finds that the cutaneous reaction to fairly high concentration of typhoid toxin, which is present in a majority of the healthy, is also inhibited by typhoid inoculation, and a similar observation was made in the case of the tuberculous. There is, moreover, some doubt as to the validity of the inoculation in the latter. The author draws the general conclusion that the skin reaction to any specific bacterial toxin is inhibited where the organism is actively engaged in dealing with other antigens.

**Diagnosis.** In a paper on the diagnosis of chronic pulmonary tuberculosis based on their experience in the department for diseases of the chest of the Jefferson Hospital, Philadelphia, McCrae and Funk state that in a series of 12,000 consecutive cases admitted as advanced pulmonary tuberculosis 72 patients, or 6 per cent., were found to be incorrectly diagnosed. The conditions diagnosed incorrectly were cardiac and cardio-renal diseases (19 cases), chronic inflammatory conditions in the lungs, usually associated with some form of pneumonic process (9 cases), bronchiectasis usually with marked fibrosis (8 cases), pulmonary abscess (8 cases), emphysema and chronic bronchitis (6 cases), new growth (5 cases), syphilis (4 cases), aneurysm, anthracosis, bronchial asthma and empyema (2 cases of each), and such miscellaneous cases as diabetes mellitus, cancer of the rectum, foreign body in a bronchus, and malingering (1 case of each). The writers maintain that the diagnosis of advanced pulmonary tuberculosis should not be made unless tubercle bacilli have been found in the sputum on at least two occasions.

Lawrason Brown and Sampson point out that while tuberculous colitis can be diagnosed clinically with a considerable degree of certainty when the disease is far advanced, in the early or latent stages when treatment may be of avail the clinical picture may be of little aid in diagnosis. In all stages certain shadows cast by the barium meal at the end of six, eighteen, and twenty-four hours determine definitely the presence of colonic ulceration, but the absence of such shadows does not absolutely exclude colonic ulceration. Skiagrams showing hypermotility and spasm or filling defects in a patient with pulmonary tuberculosis should lead to a definite diagnosis of colonic tuberculosis. The writers consider that tuberculous colitis occurs much more frequently than has been hitherto supposed and must be excluded in all advanced cases of pulmonary tuberculosis and in any early case with abdominal symptoms before submitting it to radical treatment. No examination therefore of a case of pulmonary tuberculosis can be considered complete without an X-ray study of the intestine.

Nicholson and Goetsch state that sanatorium physicians have every reason to be familiar with a group of cases showing asthenia, nervous instability, tachycardia and loss of weight, in which tuberculosis has been suspected, but in which it is not possible to find tuberculous lesions adequate to account for the whole of the symptoms present. Of this group, some are undoubtedly suffering wholly or partially from hyperthyroidism, and every means is welcome which will enable one to pick these out. History and physical examination often enable the diagnosis to be made readily, but in the more doubtful cases, Goetsch is convinced of the value of the adrenalin test. He believes that the condition of sympathetic hypersensitiveness thereby elicited, warrants the diagnosis of clinical hyperthyroidism.

The patient, at rest and under normal conditions, is first of all carefully examined for both subjective and objective sympathetic manifestations, and is then given ½ c.c. of 1 in 1,000 solution of adrenalin chloride. Following this, blood-pressure and pulse-rate are observed, and other signs and symptoms noted at intervals during an hour and a half. In a positive test there is an early rise of blood-pressure and pulse-rate, and a general exaggeration of the clinical picture of hyperthyroidism, especially of any symptoms of which the patient has complained. In most cases the reaction follows a very typical course, and there is little tendency for ordinary cases of active tuberculosis to give confusing results.

The authors believe that the test enables them to detect an early hyperthyroid element in a case at a stage before either serious disablement has taken place, or special treatment has become necessary. The comparative frequency of obvious thyroid enlargement in sanatoria is certainly sufficient to warrant careful study of all border-line cases.

Under the title of *pseudo-tuberculosis of naso-pharyngeal origin* Kohn-Enriquez describes a chronic infection of the naso-pharynx simulating pulmonary tuberculosis. Locally it is manifested by (1) a more or less marked obstruction at the anterior or posterior part of the nasal cavity or in the naso-pharynx, (2) the presence in the nose of a secretion rich in micro-organisms and sometimes of a definitely purulent fluid derived from the sinuses. The mechanical obstruction to the entrance of air into the upper respiratory tract by forcing the patient to breathe through the mouth causes a spasm of the glottis which progressively increases with the length of the inspiration and accounts for the respiratory insufficiency which results from the nasal obstruction. If the latter dates back to childhood, the thorax is ill-developed, and a series of skeletal deformities ensues. Moreover, as the apices, which even in the normal state form the least mobile part of the lungs, do not show any respiratory activity, their alveoli become little if at all filled with air. The more or less constant swallowing of the septic post-nasal secretion has a pernicious influence on the system. The resulting intoxication, which is mainly gastro-intestinal, explains most of the general symptoms such as loss of flesh, anaemia, dyspepsia, nervous disturbances, sweating, fever, and albuminuria. The functional symptoms such as cough, expectoration, and haemoptysis are always due to lesions situated in the upper respiratory tract and not as in tuberculosis in the lung substance. The diagnosis of pseudo-tuberculosis is made by laryngorhinoscopic examination and radioscopy. An error of diagnosis may have serious consequences, as chronic affections of the naso-pharynx form one of the principal causes of individual predisposition to pulmonary tuberculosis. The patients are sent to a sanatorium where they contract tuberculosis all the more readily as they offer only a weak resistance to the tubercle bacillus. Under local treatment of the naso-pharyngeal condition the physical signs and general symptoms subside, and breathing exercises controlled by measurement of the chest and radioscopy will help in recovery.

It is not generally known that a focal reaction sometimes occurs after von Pirquet's test, though a few cases of the kind were described by Burghardt in 1910. In Romberg's clinique at Munich, where von Pirquet's test is performed in every suspected case of tuberculosis before the subcutaneous test, Allinger-Stein found that out of 69 cases in which von Pirquet's test was positive 5 showed a distinct focal reaction. In 2 this consisted in the development of impaired resonance or exaggeration of that already present. In the other 3 cases râles were the only manifestation of the focal reaction. In 4 other cases there was a general reaction in the form of a rise of temperature, as has been described by Bandelier-Röpke, Moro, and others. The focal reaction in the 5 cases developed 24 hours after inoculation, and in 1 case it was most distinct after 48 hours. It subsided with varying rapidity in the different cases. In 2 the auscultatory signs disappeared before the signs obtained by percussion which in 1 case were distinct for 4 days. The rapid development of the focal reaction showed that absorption rapidly occurred in spite of the small amount of tuberculin used. A subcutaneous injection of old tuberculin is unnecessary in cases where the activity of the disease is proved by a focal reaction with von Pirquet's test. On the other hand, the absence of a focal reaction with von Pirquet's test is no guide to the activity or otherwise of the pulmonary affection.

According to Klopstock the intracutaneous tuberculin test is in several respects superior to von Pirquet's, which, even with the Ellermann-Erlandsen quantitative modification, is comparatively inaccurate in the matter of dosage. Three aspects of the intracutaneous test have been studied. (1) Technique. (2) The relation of this to the other tuberculin tests. (3) The ability, if any, of the intracutaneous test to discriminate between infection and infection plus disease. The procedure found most satisfactory was the simultaneous injection of 1/10,000, of 1/1,000, of 1/100 mgm. of tuberculin and of 1/10 mgm. of glycerine-bouillon in 0·1 c.c. of fluid. Higher concentrations of tuberculin are apt to irritate too much, and should be given only when no reaction has followed the injection of 1/100 mgm. of tuberculin. The control glycerine-bouillon injection is necessary, as it alone may in certain cases provoke a reaction. The injections of the different strengths of tuberculin are given simultaneously, as consecutive injections may alter the reaction of the skin. The injections require the most painstaking cleanliness, and different needles should be employed for each injection. The inflammatory infiltration indicating a positive reaction, shows variations of quality, quantity, and duration. Phases of latency, development and decline are observed as with von Pirquet's test. Severe local disturbances were never seen, but very sensitive patients may react with slight fever. Fifty patients, suspected of tuberculosis, were tested first by the intra-, then by the sub-cutaneous test. They did not always agree. In some cases there was a violent local reaction after an intracutaneous injection, whereas high subcutaneous injections (5 and 10 mgm.) were needed to provoke a febrile reaction. In other cases, 0·5 mgm. was sufficient to provoke fever when injected subcutaneously, whereas the intracutaneous test was positive only with a dilution as concentrated as 1/100 mgm. The intracutaneous test, when positive, undoubtedly indicates previous infection with tuberculosis; in no case was it negative when other tuberculin tests were positive. Indeed, among the 50 cases there were three in which the subcutaneous injection of 10 mgm. of tuberculin failed to raise the temperature, while the intracutaneous test was definitely positive. It is therefore the most sensitive and reliable test of infection. But it does not discriminate between infection and infection plus disease.

Jost reports a striking series of cases tested by Abderhalden's reaction. With a few exceptions the ordinary technique was employed. The serum was tested against healthy pig's lung, and also in many cases against liver and kidney. 5 c.c. of dialysate was taken instead of the usual 10 c.c. in order to make the ninhydrin test sharper in colour, and at the same time more significant. Every possible precaution was taken in the preparation and retesting of the substrate, and all the experiments show controls with serum only.

Of 54 cases with clinically active tuberculosis and bacilli in the sputum, 52 reacted positively with lung. Clinically quiescent cases were mostly negative, the few which were positive corresponding very largely with those of which the activity was doubtful. Other lung conditions (malignant disease, bronchiectasis, pulmonary stasis) showed a positive reaction when clinically progressive. A series of control cases with healthy lungs showed uniformly negative results. Many of the cases with advanced lung disease reacted positively to liver or kidney or both, and the latter were mostly cases with a grave prognosis. In a fair number the test corresponded with known clinical conditions (nephritis, amyloid disease, &c.) and others were verified *post mortem.*

With regard to the general value of the reaction, the author does not claim that it will make an absolute diagnosis, but that it will determine definitely whether a known case of pulmonary tuberculosis is active or inactive.

**Treatment.** Schröder (1) reviews once more the current German work on specific and general drug treatment of tuberculosis. Treatment with partial-antigens (Deycke-Much) is being extensively tried, and on the whole, judgement appears favourable; but the author opposes the high dosage of the Deycke-Alstaedt scheme which gives rise to focal reactions of a dangerous character. He recommends starting with 0·1 c.c. of the $\frac{1}{100}$ dilution of the 'Partigen' solution and increasing the dose by 0·1 c.c. at intervals of several days until the injections appear to be well borne.

Subcutaneous injections of tuberculin for diagnostic purposes have fallen very largely into disuse. Their use appears dangerous and their interpretation doubtful.

Friedmann's preparation has still many devotees, but the evidence at present remains somewhat conflicting (vide *Medical Science*, 1919, **1**, 167, *et infra*).

Much work is being done on the gold treatment of tuberculosis. The author has seen good results in serous membrane tuberculosis with Aurocantan (cantharadin-ethylene-diamino-auro-cyanide) but it is not good for the kidneys. A better compound has been put forward under the name of Krysolgan (sodium salt of an amino-auro-phenol-carbonic acid) which is given in doses of 0·1 gm. in 4 c.c. of distilled water, intravenously at 10 day intervals. There is no doubt of its ability to produce focal reaction, which can be seen in the larynx. The author saw good results in pulmonary and laryngeal cases. He recommends Calot's treatment of tuberculous lymph-glands by his phenol-camphor solution. German opinion is turning very much against the indiscriminate employment of morphia in haemorrhage, and favours moderate activity in the congestive type of haemoptysis.

In an exhaustive paper Königer deals with the general question of the treatment of fever, with special reference to the fever of tuberculosis. He discusses the modern theory of the increased irritability of the heat-centre under the influence of toxic decomposition products of protein, and of the sensitization of the heat-centre to foreign protein; but thinks that Friedberger goes too far in assigning all infectious fever to anaphylaxis. In other words, there are many toxins which are directly pyrotoxic. An interesting historical survey shows the fluctuations of opinion with regard to the question of how far fever should be treated as such, and within what range it is beneficial to the organism in meeting infectious disease. Much evidence has accumulated to show that moderate fever is all in favour of the organism and against the infecting agent, and antipyresis whether by hydrotherapy or by chemical agents has had to meet much criticism.

But before this question can be definitely settled, it is necessary to ask whether it is really possible to treat pyrexia alone and symptomatically? If by careful dosage and choice of agents, chemical antipyresis can be freed from obviously harmful accompaniments such as signs of collapse, circulatory disturbances and unpleasant subjective phenomena, is it still possible by this method to reduce temperature only? The author replies in the negative. So far as chemical antipyresis goes, he is convinced that the response is general and concerns more than the heat-centre. Thus he finds that in tuberculosis, focal reactions at the site of disease follow chemical antipyresis, as well as general reactions with temperature rise beyond the original limit; indeed they occur at afebrile periods if antipyretics be administered.

The author sees in these facts no ground for condemning chemical antipyresis, but an opportunity for producing heightened resistance to disease by the careful use of the antipyretic drugs. He condemns continuous antipyresis on the ground that it veils the after-effects and may cause over-absorption of toxin, and wishes to substitute a system of regular intermittent dosage with careful study of the clinical phenomena in the intervening periods.

In tuberculosis the natural course of the fever is first determined by 2-hourly rectal records, then the effect of single doses of pyramidon at different times of the day is tried, and an attempt to estimate the primary and secondary effects of such single doses is made. One can then proceed if desirable to regular intermittent treatment with 3–4 day pauses, and so on to continuous antipyresis.

Pöhlmann's paper deals with the exact study of the effect produced on tuberculous pyrexia by the commoner antipyretics in use in Germany. He passes somewhat rapidly over the precise indications for antipyretic treatment, contenting himself with the observation that it is desirable in prolonged high fever with toxic phenomena, but not in more moderate fever unassociated with subjective symptoms.

Choosing a patient with a rectal temperature curve showing fairly constant daily variations between 37·2 and 38·4, the author studied the effect of the various drugs given with periods between the separate administrations sufficient to allow the curve to re-establish itself at its original level. He found that it is between the salicylic acid group (aspirin, diplosal, salipyrin, &c.), and the quinine group that the most marked contrast in mode of action lies. The former group is characterized by its vigorous effect even on the highest temperatures, the fall being rapid in onset, and steep in profile, with an undesirable tendency to produce heavy sweating and collapse. Quinine, on the contrary, is nothing like so powerful in small doses. The fall is more gradual and more even. Between these two in point of action lie the coal-tar derivatives, e.g., lactophenin and pyramidon.

The author recognizes the salicylic acid group as more suitable for high continuous, the quinine group for high remittent fever. With this principle in view, it is possible by suitable combination of these various agents, to reduce the dosage to a limit which avoids the troublesome sequelae which follow their constant use. The most valuable combinations were found to be:—Aspirin or Diplosal grs. 4 with Lactophenin grs. 4, or Pyramidon gr. 1; Lactophenin grs. 4 with Pyramidon gr. 1; and Quinine grs. 1½ with Lactophenin grs. 4, or Pyramidon gr. 1. In each case these doses were repeated 3 or 4 times in the day.

Doubts as to the specific properties of tuberculin are almost as old as tuberculin itself, and Mathes in 1895 maintained that every reaction following the administration of tuberculin could also be provoked by deutero-albumoses. Investigations made during the last few years by Schmidt and Kraus at the German medical clinique in Prague seem to confirm this hypothesis, the injection of milk evoking responses closely resembling the various responses to tuberculin. Records of 16 (consecutive ?) cases of tuberculosis are given, showing how the injection of 0·5 to 2 c.c. of boiled milk invariably provoked general, local, and focal reactions followed by euphoria, gain of weight and other signs of improvement. During the first, negative phase, the temperature may rise to 102·2° F., and the intensity and extent of the chest signs may increase considerably and be accompanied by pain. If the injection (usually subcutaneous, sometimes intramuscular) be given in the morning, the negative phase may be superseded by the positive phase as early as the evening of the same day. The patient sleeps better, breathes more easily, and feels generally better. And as with tuberculin, a certain degree of tolerance is acquired, necessitating an increased dosage. The indications for this treatment are also the same as for tuberculin; rapidly progressive cases are unsuitable, the torpid, more or less afebrile, fibrotic type of case is most suitable. A course of injections lasts three weeks, the injections being given at intervals of three to four days. The milk is sterilized by boiling in a water bath for ten minutes, and when it causes excessive pain injected hypodermically, it is injected into the muscles. It may be claimed that milk is as beneficial as turberculin: but is it less dangerous? Certainly high hopes are not yet justifiable.

Brecke reviews the present position of heliotherapy, especially with reference to its increasing use in pulmonary tuberculosis. Actinometric observations reveal the enormous energy available not only at the Alpine resorts, but at places much less favoured in altitude and meteorological conditions. Much evidence has accumulated which points to the effect of insolation on general metabolism, and it is to this action that the author ascribes its chief value. He cites recent work suggesting that the melanotic pigment which is synthesized in the basal cells of the epidermis, has the power of turning rays of short wave-length into long. It is upon the latter rays that the Alpine resorts rely in the winter, since the ultra-violet radiation is reduced enormously at that season. The evidence points largely to the heat-rays as the important healing factor, and experiments on the penetration of tissue show that the rays of long wave-length travel farthest, while the violet and ultra-violet rays are arrested in the dermis and epidermis respectively. The maximum penetrating power rests with the infra-red part of the spectrum.

The author's method of administering general irradiation is that of five minute exposures daily from the feet upwards, gradually increasing in time and area until the whole trunk and limbs are exposed. He has observed slight focal reactions in the lungs with temperature disturbances and subjective symptoms which indicate the necessity for caution. General improvement which appears to be largely attributable to the sun treatment, has followed in a great majority of cases, especially in serous membrane tuberculosis. Specially noticeable was the effect in relieving the subjective symptoms of pleurisy.

The author concludes with some architectural observations with regard to buildings intended for heliotherapy, and with a short climatological study.

In an article on the treatment of enlarged mediastinal glands in children by heliotherapy, Dufourt states that this method is not suitable in every case. The most favourable type is that in which the disease is confined to the glands. In such cases the symptoms and physical signs disappear under treatment in four to six months, the results of clinical examination being confirmed by radioscopy. On the other hand, when the glandular condition is complicated by infection of the lungs or bronchi, a cure is not so easily effected. The time of exposure to the sun's rays must be shortened and the treatment must therefore extend over a longer period, a year at least being required. Even then some symptoms may persist, such as an unsettled temperature or a liability to bronchitis. Lastly, some cases cannot stand the treatment at all. The older the child, the more readily is a cure obtained. In infants the treatment is often followed by a rise of temperature to 102·2 or 104° F., and erythema is more frequent than in older children. In cases where the tubercle bacillus has definitely invaded the lung it is very exceptional for any benefit to be derived from heliotherapy, and the majority of cases are undoubtedly aggravated by the treatment.

Abbott reconsiders the treatment of tuberculous cervical glands in the light of Wood's anatomical studies, which have enabled the respective involvement of the superficial and deep groups of glands to be more accurately estimated. The first glands to become infected are those of the upper triangle, and clean dissection of these, avoiding rupture of the capsules, if done before softening takes place, and before the limits of the triangle have been passed, will not, in the author's experience, be followed by recurrence if all enlarged glands are removed. Such early operation will save deep involvement, and possibly later pulmonary metastasis.

But once the deep system is invaded it is impossible to remove surgically all the infected glands, and extensive dissections have not proved justifiable.

Hence it is important to eliminate involvement of the deeper glands by thorough examination of the neck and chest. In addition to palpation of the neck and axilla, and determination of the usual signs of bronchial gland enlargement, the author attaches special importance to bruit over the supra- and infra-clavicular regions.

But while approving of early surgical interference, he has seen many cases cured by medical treatment, and favours tuberculin, preferably by local injection, with an initial dose of ·0001 mgm. gradually increased to tolerance at intervals of about five days. He warns against potassium iodide, in which the potassium seems to be the harmful factor. Broken-down pus-filled glands should be aspirated dry by suction and filled with

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| Cinnamon | 1 part |
| Benzoin | 3 parts |
| Corn Starch | 10 parts. |

If possible it should be insufflated through a tube; if not, it should be mixed with a little water and injected.

Gammons, who has treated 98 cases of pulmonary tuberculosis by **artificial pneumothorax** considers that children and old patients are usually not good subjects. Very nervous patients should also be excluded, unless the nervousness is of toxic origin, as well as subjects of cardio-renal vascular disease. He has found that the treatment of left-sided cases is not so hopeful as that of the right-sided. In nearly half the left-sided cases he has found marked displacement of the heart, and in a great many instances vomiting was frequent, being apparently due to pressure on the stomach. In a few instances left-sided cases had severe headache. In about 20 per cent. of his cases pleural effusion occurred, which in many instances became purulent. As regards dosage he recommends that 300 c.c. should be given at the first attempt and then every two or three days until the lung is collapsed. If after a few attempts numerous adhesions are found to be present, preventing a complete collapse, the case should be given up as a failure. The best results are obtained in the ulcerative cases. Unilateral cases with much sputum and fever should not, in his opinion, be treated by artificial pneumothorax, even though the entire lung is full of large moist râles, as the collapse will tend to tear up the fibrosed areas.

Alley states that when treatment by artificial pneumothorax was first introduced at the Rutland State Sanatorium, Massachusetts, in August 1911, it was looked upon as an experiment and was tried in a large number of cases in the different stages of pulmonary tuberculosis. The majority of the cases after fair treatment were regarded as unsuccessful, the results reported in 1914 being as follows: 23, or 31 per cent. out of 74 cases were benefited, while 51, or 69 per cent. showed no improvement. Many of the unsuccessful cases were due to dense pleural adhesions or were examples of extensive bilateral disease. During the last three years, however, only 21 carefully selected cases have been treated at this sanatorium by artificial pneumothorax, two being in the incipient stage, ten in moderately advanced, and nine in the far advanced stage. Fourteen were benefited and seven were improved. Special success was obtained in treating haemoptysis by this method. Alley emphasizes the importance of making a proper selection of cases, which is only possible after the individual has been in the sanatorium several months. He considers that there can be no fixed dosage of gas, but that the amount given at each treatment should vary according to the individual and the interval between the doses.

Pearson's article on the effects of artificial pneumothorax is based on the experience derived from 21 cases of severe pulmonary tuberculosis whose pneumothorax he had induced artificially between August 1910 and December 1916, except in one case which had developed a spontaneous hydro-pneumothorax and was converted by him into a controlled pneumothorax. 11 of the 21 cases were alive, and 9 of them were enjoying good health and pursuing their usual vocation. Nearly all the fatal cases had their symptoms much alleviated and their lives prolonged, in some instances by years, during which they enjoyed fairly good health and followed their occupations. Pearson recommends that an artificial pneumothorax should be kept up if possible for at least three years, provided it is an effective one. Under the following circumstances he advises continuing with an occasional injection for at least four and a half years, viz., (1) if the patient is over 33 years and has lost the resilience and recuperative power of youth, (2) if the compressed lung was a fairly useless one before the initial injection, (3) if things are going well during the maintenance of the compression. In some cases compression may have to be maintained indefinitely, either because the patient is more comfortable with periodic refills or because the compressed lung does not re-expand.

According to Stolkind, artificial pneumothorax has been rarely employed in children, even in the most suitable forms of pulmonary tuberculosis. The ideal case, of which he reports four examples in children aged from 12 to 17, is one of advanced pulmonary tuberculosis with ulcerative one-sided disease, the other lung being at least clinically normal. Radioscopy is essential, as it shows the extent of disease in the lungs, the part most affected, the location of deep-seated areas of consolidation, as well as of small cavities which cannot be discovered by other means, the presence of slight pleural effusion and the mobility of the diaphragm. After introduction of the gas the X-rays show whether the pneumothorax has really been performed, how much the lung cavities are compressed, the presence and position of pleural adhesions, &c. Radioscopy also reveals the displacement of the heart and mediastinum, the compression of the other lung, the diminution or increase of pleural adhesions, and the presence of cavities, pneumonia, &c., in the other lung. It is also a guide as to when to make the refills and how much gas should be introduced each time. As regards the dosage Stolkind is of opinion that not more than 500 c.c. of gas should be introduced at once. The amount of gas introduced each time and the intervals between refills in children depend upon (1) the pressure in the pleural cavity, (2) the degree of displacement of the heart and mediastinum, (3) the state of the collapsed lung, (4) the rapidity of gas absorption, (5) the patient's respiration, (6) the general condition, (7) the child's behaviour during the insufflation of the gas. As a general rule the refills during the first months should be made every seven days, and later every two to six weeks. The same complications of pneumothorax treatment may occur in children as in adults, the most frequent being subcutaneous emphysema which occurred in nearly 90 per cent. of Stolkind's cases, and pleural effusion which occurred in about 75 per cent. The influence of the effusion on the course of pulmonary tuberculosis varies. The improvement often observed after its occurrence is attributed by Stolkind not only to immobilization of the lung but also to the serobiological influence of the effusion which contains many antibodies. He concludes that artificial pneumothorax should be employed not only in adults but also in children in every case of advanced tuberculosis, but not as a last resort when it is too late.

It is a common observation in chronic pulmonary tuberculosis that pleurisy, especially when accompanied by effusion and occurring on the side of the more advanced disease, appears to induce a tendency to healing in the underlying lung focus. It has often been debated whether the cause is mechanical or serological, but the result is an increased tendency to fibrosis and encapsulation.

Schröder (2) brings forward additional evidence that pleural stimulation induces changes in the lung. Three cases are quoted in which artificial pneumothorax could not be induced. All were febrile and responded to the attempt by the onset of diffuse dry pleurisy. The fever disappeared, the general condition improved, and the lung disease became quiescent. The pleura was entered with Salomon's cannula (blunt method), after cutting down to the intercostals, and efforts were made to separate the pleural surfaces. The author suggests the trial of injection of a few c.c. of ½–1 per cent. silver nitrate with a view to inducing a similar reaction in suitable cases.

Bock was able to trace five out of seven patients whom he had treated with **Friedmann's remedy** five and a half years previously and found that they had all been cured. The affected areas of the lungs were completely cicatrized, and there was no sign of active disease. The reaction, especially in infants and old persons, was much less than after vaccination against small-pox. Before the introduction of Friedmann's vaccine Bock had treated almost all his cases of tuberculosis with various forms of tuberculin, and from the middle of 1914 to the end of 1918, during which time Friedmann's vaccine was not available, he had again resorted to tuberculin. A comparison of the two methods was therefore possible. Permanently good effects from tuberculin he had never seen; a tuberculin course of 15–20 injections being required every one to two or three years, whereas a single inoculation with Friedmann's vaccine appeared to be sufficient.

The question as to when pulmonary tuberculosis can be said to be cured forms the subject of a note by Rénon. During the last seventeen years he has employed the following test, which he has used alike for patients leading a sedentary or an active life in the town or country, only those who are engaged in heavy work being excluded. The test is carried out for a period of three months and consists in making the patient work a few hours every two days in the morning or afternoon, then increasing the number of hours and finally making him work both morning and afternoon. During the first two months the work should be interrupted by days of rest, the frequency of which should be gradually curtailed, and in the third month the work should be carried on uninterruptedly. Throughout the duration of the test the patient's weight, temperature, blood-pressure and lungs should be examined at regular intervals. A slight loss of weight and fall of blood-pressure may be disregarded, but the same cannot be said of a rise of temperature, cough, fresh expectoration, or the presence of slight inspiratory râles on auscultating the supraclavicular fossa. When this test has been successfully passed, the affection may be regarded as relatively cured. The time of year most favourable for the test is the end of summer and autumn so that the patient may be prepared for the critical period of spring.

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# SYPHILIS

**Prophylaxis.** Of the various measures suggested to diminish the prevalence of venereal diseases, moral and educational methods are now generally recognized as insufficient. It is becoming increasingly evident that, although something may be done by education of the public in the dangers of these diseases and by moral persuasion, the question is essentially a medical one, and should be looked upon from the point of view of preventive medicine, in the same way as other infectious diseases. This being accepted, the chief point of controversy concerns the relative value of personal prophylaxis and what is known as 'early treatment'; in other words, immediate personal disinfection as against disinfection carried out at a centre for treatment as soon as possible after exposure to infection. The latter procedure was that recommended by the National Council for Combating Venereal Diseases.

A White Paper recently presented to the Minister of Health by the Interdepartmental Committee on Infectious Diseases in Connexion with Demobilization contains the following conclusions as regards the prophylaxis of venereal disease:

(1) That certain drugs, if properly applied, are efficacious in preventing venereal disease.

(2) That if these drugs are not properly or skilfully applied their efficacy cannot be relied upon.

(3) That the issue of 'prophylactic packets' tends to give rise to a false sense of security, and thus to encourage the taking of risks which would not be otherwise incurred, and the neglect of facilities for early treatment when available; and, in certain circumstances, might even increase the spread of disease.

(4) That, in spite of the most careful instructions, the grant or issue of 'packets' results in many an individual using them for self treatment after he finds himself infected. They are not intended for this purpose, and are ineffective when so used. Drugs which are accredited with the power of preventing diseases are very frequently accepted by the public as useful in their treatment. Their use for the treatment of developed disease may be definitely harmful, since they delay diagnosis and the application of proper treatment at a time when promptitude is of the very first importance to its success.

(5) That when preventive treatment is provided by a skilled attendant after exposure to infection, the results are better than when the same measures are taken by the individual affected, even after the most careful instructions.

(6) That the excessive consumption of alcoholic liquors not only diminishes the sense of responsibility, but also tends to prevent the proper use of prophylactics and to delay the individual's application for skilled treatment.

(7) That the most carefully organized packet system, such as exists now in the army (a system which would be unattainable in the civil community) has not produced such a general reduction in the incidence of

venereal disease as to counteract the disadvantages mentioned in these conclusions.

(8) That the organization of recreation and social amenities has assisted in the reduction of the incidence of venereal diseases in the services before the war, and has also assisted in preventing that increase in the incidence of these diseases which, from past experience, might have been anticipated during the war.

(9) That energy should not be dissipated in measures of doubtful value, but concentrated rather on wise propaganda and the provision of early, prompt, and skilled treatment in order to diminish the prevalence of these diseases. It should be recognized that failure to cure these diseases is one of the main causes of their prevalence, and that failure to cure, in the most skilled hands, results largely from failure to treat them in their early stages.

The Committee sums up as follows: 'Unquestionably there have been many individual cases which appear to afford positive evidence in favour of a system of distribution of such prophylactics before exposure to infection; but the volume of such evidence is too small and too exceptional, and the instances of its failure, even under favourable circumstances, are too numerous to allow of any other conclusion than that, in view of the considerations mentioned above, and of the administrative and social difficulties involved, the official application of a packet system to the civil community is neither desirable nor practicable.'

As a counterblast to the above, a Committee containing the names of several well-known authorities and experts in venereal disease has been provisionally formed under the Chairmanship of Lord Willoughby de Broke. This Committee, designated 'The Venereal Prevention Committee', has issued the following manifesto:

'In view of the White Paper recently presented to the Ministry of Health containing the decision that the official recognition of self disinfection in civilian venereal disease is 'neither desirable nor practicable', we think it urgently necessary, in the interests of the national and racial health, to ask our fellow citizens for the action which the official forces of the nation find themselves unable and unwilling to take'.

This Committee recognizes three possible courses: (1) to take no action against venereal infection apart from moral teaching; (2) delayed disinfection, at 'early treatment' centres; (3) immediate self disinfection. The first course is rejected. As regards the second course, the Committee point out that centres for early treatment, or 'delayed disinfection', as they term it, are not and never can be adequate; that the practical difficulties both in town and country are insuperable; and that time, the vital factor, is lost in every case. There remains only the third course, self disinfection. By this means they hold that venereal disease is preventable; that authoritative teaching on the subject is urgently required; and that such means should be readily accessible to the public. They fail to recognize any moral distinction between the provision of delayed disinfection at treatment centres and the provision of immediate self disinfection.

**State control of venereal disease.** In the United States the measures adopted to control venereal disease are described in the reports of the Public Health Service. These measures are as follows: (1) Notification of cases of venereal disease to the health authorities, the records to be secret; (2) Isolation and treatment in detention hospitals of infected persons who are unable or unwilling to take measures to prevent their becoming a menace against others; also measures for the suppression of prostitution; (3) Educational measures, including information of the general public concerning the nature and manner of spreading of venereal diseases and the steps to combat them; (4) Extension of facilities for early diagnosis and treatment; (5) Prohibition of prescribing by druggists. The V. D. campaign, as waged by the U. S. Public Health Service, by the Section on combating V. D. of the Surgeon-General's Office, United States Army, and by the 'Law Enforcement Division of the Commission on Training Camp Activities', together with numbers of State and private and semi-official organizations has developed the following definite results: It is becoming rapidly recognized (1) that health departments must also assume their share in the fight against venereal diseases which has heretofore been chiefly waged by educational and police organizations; (2) that the principles governing the control of venereal disease are essentially the same as those of any other communicable disease. These principles have been carried into effect in many of the States by rendering persons who are a danger to the public health on account of venereal disease subject to quarantine.

The standards to be followed before discharging patients as non-infectious required by the U. S. Public Health Service are as follows: In the case of syphilis, no case should be regarded as cured for at least one year after the termination of treatment and till the following conditions have been satisfied: (1) absence of treatment for a year during which there have been no symptoms and several negative Wassermann reactions; (2) a negative provocative Wassermann test; (3) negative spinal fluid test; (4) negative physical examination of the circulatory and nervous systems; (5) a luetin test may also be included. In the case of gonorrhoea; (1) absence of discharge and of shreds in the urine; (2) four successive negative examinations for gonococci at weekly intervals after prostatic massage; (3) negative examination for gonococci after passage of a full-sized sound. In the case of females; (1) absence of urethral or vaginal discharge; (2) two successive negative examinations for gonococci in secretions of the urethra, vagina, and cervix, with an interval of 48 hours and repeated on 4 successive weeks. The most noteworthy of the regulations adopted by the United States Public Health Service are notification and the power to enforce quarantine. The question of prophylaxis is not discussed in the Reports.

**Treatment.** In a leading article, the *New York Medical Journal* puts the question 'Is the modern treatment of syphilis a success?' It is pointed out that many physicians who have been long in practice can recall cases of syphilis, treated by mercury and iodides for two or three years, which they have had under observation for many years, during which time the patients presented no signs or symptoms of the disease. They can also recall cases where the disease has appeared twice in the same patient after the above treatment, showing cure of the first infection. Now that the former treatment is replaced by intravenous injections of one of the arsenical compounds supplemented by mercurial injections, the question is asked whether we are any better off than we were before; also, which is the remedy, the arsenic or the mercury? The writer of the article comes to the conclusion that the results of the modern treatment of syphilis are far from convincing, and suggests that the entire question should be reconsidered and statistics collected and collated, so that the profession of medicine and the public should be assured of any real value which this modern treatment possesses.

In this connexion an article by Le Comte on 'Criteria as to Cures in Syphilis' is of interest. This author reminds us that 'the newer methods of treatment have rendered many physicians so enthusiastic over prospects of cure that they have either forgotten or have discarded the dicta of older syphilographers who, while they lacked the refined apparatus for treating the disease that we possess, did have what no one can yet have attained with the newer methods—an extended experience with the remedies at their command and a long period of observation of their patients after treatment had been discontinued'. He goes on to say that the question of cure may be regarded from one of three points of view: (1) the clinical, which is still of great value, but unreliable unless observation is thorough and very prolonged; (2) the laboratory, the methods of which enlarge our view, but also require careful application over long periods; (3) the post-mortem room, where the presence or absence of spirochaetes in syphilitic lesions is taken as an index of cure. As an example of this method the researches of Warthin are important, but their weak point lies in the failure to demonstrate the pathogenicity of the spirochaetes observed by him owing to technical difficulties. The distinction between spirochaetes in post-mortem specimens is very difficult. In attempting to establish a standard of cure, therefore, clinical experience and laboratory tests must work in conjunction and be extended over a long period of observation, as required by the older syphilographers.

Fournier laid down the following requirements: (1) absence of existing lesions; (2) advanced age of the disease (three or four years as a minimum); (3) a period of absence of symptoms of 18 months to 2 years; (4) benign character of the disease; (5) sufficient treatment. First, as regards absence of clinical symptoms, we may now add negative serological tests, normal cell count and globulin content in the spinal fluid, and negative provocative reaction. Although the luetin test has been shown to lack specificity, a negative reaction is in favour of cure. Secondly, Fournier's time limit of three or four years cannot safely be shortened. Thirdly, since relapses sometimes occur after 18 months, it is not safe to reduce Fournier's period to 2 years for absence of symptoms. Fourthly, as regards the benign or severe type of disease, it is impossible to estimate the future of a case from its present symptoms, a fact which Fournier himself often remarked. Fifthly, Fournier's requirement of three or four years' treatment may perhaps be shortened by modern arsenical treatment, but sufficient time has not yet elapsed to learn its true value. Under the older methods of treatment paresis and other late manifestations developed about 15 years after infection with an intervening period of good health. If in 1925 or 1930 it can be shown that these lesions develop later after arsenical treatment, giving the patient a longer period of healthy life, or that they are less severe and more amenable to treatment, we may consider the drug an advance; otherwise, it must be considered only as an agent for the rapid control of symptoms.

The author concludes that mercury has not been superseded by salvarsan and should be used in every case, and that all of Fournier's requirements for cure before marriage hold good except that of length of treatment, which may be reduced.

W. T. Williams describes the treatment carried out since 1915 at the Special Clinic of the Toronto General Hospital. From November 1915 to September 1918 there were 899 cases under treatment: 90 in the primary stage, 170 in the secondary stage, 639 in the tertiary or latent stages. The method of treatment was by intravenous injections of arsphenamine (the American substitute for salvarsan) followed by intramuscular injections of salicylate of mercury. In the later stages of syphilis large doses of iodides were also given. No arbitrary rule was laid down as to the number of injections, as some patients require more than others; also, the degree of tolerance varies in different subjects. Treatment was continued until two or three consecutive negative Wassermann reactions were obtained, or until the patient showed signs of having reached the limit of tolerance. This is shown by slight reddening of the forearms, a warning of acute dermatitis. After two or three negative reactions, treatment was abated and the patient told to report in a month. If the reaction was still negative, an interval of three months was allowed before the next test. This control was kept up for two years, further treatment being given if the reaction returned to positive. Cerebro-spinal syphilis was treated in the same way unless the results were nil. In this case intraspinal treatment with serum withdrawn an hour after an intravenous injection was performed. Another method used was the withdrawal of 10 to 40 c.c. of spinal fluid immediately after intravenous injection. This appeared to have the same effect as intraspinal injections. The results of the above treatment, when continued for two years, showed the following percentages of cures: primary cases, 82; secondary, 67; tertiary, 43. As the author points out, the results of treatment are better when patients come in the early stages of infection. He holds that too much significance should not be attached to laboratory tests for the diagnosis and cure of syphilis. Some patients give a positive Wassermann test even after two years of vigorous treatment, but all physical evidence of the disease may have disappeared. He mentions a case of sore on the foreskin which was excised and stained by Levaditi's method with negative results, but in three months secondary syphilis developed. As he truly remarks 'when in doubt regarding a sore, treat as syphilitic'.

On comparing the relative value of intravenous and intramuscular injections of novarsenobillon, Leonard concludes that better results were obtained by the latter. By this method 95 per cent. of the cases gave a negative Wassermann reaction as against 88·5 per cent. after the intravenous method. The advantages of the intramuscular method are slower absorption and excretion, thus producing a more durable effect. The disadvantage is pain, which varies in different subjects. The cases treated comprised 428 of primary and secondary (260 intravenous; 168 intramuscular), and 83 of tertiary syphilis (66 and 17). The latter included glossitis, leucoplakia, gummas of various regions, laryngitis, periostitis, and central nervous syphilis. In all these cases the symptoms disappeared or improved. The intravenous injections were given in concentrated form in 5 c.c. of distilled water, in doses of 0·45 to 0·75 gm.; the intramuscular in 10–15 c.c. distilled water shaken up with 'creocamph' to 20 c.c., in doses of 0·45 to 0·6 gm. Intramuscular injections of 1 grain of mercury in mercurial cream were given simultaneously in all cases. The normal army course of seven injections at weekly intervals with a fortnight's interval between the third and fourth, and fifth and sixth was adopted.

The employment of adrenalin to counteract the vaso-motor phenomena sometimes following the injection of salvarsan was first advocated by Milian. Beeson describes the use of adrenalin in such reactions following the intravenous injection of arsphenamine and neoarsphenamine and discusses the theories as to the causation of these reactions. One of the most common reactions is that described by Milian as 'nitritoid crisis', from its resemblance to the effects of inhalation of amyl nitrite. This is characterized by redness of cheeks, lips and ears, a feeling of suffocation, sometimes nausea and vomiting, rapid thready pulse, and in severe cases swelling of the lips and tongue and conjunctival injection. Syncope may occur. These attacks may take place during or soon after an injection, or several days later. They are rarely fatal. A rarer and more dangerous reaction is that termed by Milian 'serous apoplexy', which corresponds to what others have called haemorrhagic encephalitis. This generally appears on the third or fourth day after injection, and is characterized by rise of temperature, facial congestion, stertorous breathing and epileptiform seizures, followed by coma and death. Milian is of opinion that adrenal insufficiency plays a large part in the causation of the above phenomena: the vaso-dilator properties of the arsenical preparations in the presence of diminished adrenal activity giving rise to the nitritoid crisis and serous apoplexy.

This view is supported by the presence of disseminated punctiform haemorrhages in the brain (Marschalko). In some fatal cases, however, death was apparently due to the toxic action of arsenic on the renal epithelium (Warthin). Other explanations are given by other observers. Beeson, after having seen a number of cases of nitritoid crises favours Milian's view of their causation. In a series of 500 intravenous injections of arsphenamine (including diarsenol and arsenobenzol-billon) nitritoid crises occurred in about 3 per cent. As they may occur after the first injection anaphylaxis will not explain them. All injections were given in a dilution of 0·1 gm. arsphenamine to 25 c.c. of bidistilled water, and the average time of injection of 0·6 gm. occupied 7 or 8 minutes; hence the crises do not appear due to too great concentration of the solution or to excessive rapidity, as some have stated. As the author has not seen a case of 'serous apoplexy' he expresses no decided opinion as to its etiology, but he does not favour the view that it is due to a 'Herxheimer reaction' affecting the meningeal and cerebral vessels, because it does not usually appear till the third or fourth day following injection, while the Herxheimer reaction occurs within 36 hours. To prevent the occurrence of nitritoid crises and serous apoplexy, Milian recommended 1 mg. of adrenalin by the mouth (1 c.c. of the 1 in 1,000 solution), the same dose subcutaneously, and half this dose intramuscularly. The author prefers intramuscular administration, and considers that 2 mg. (2 c.c. of 1 in 1,000 solution) is sufficient as a preventative of nitritoid crises in patients liable to these attacks. It will also shorten an actual crisis when given during the attack.

Milian reports a remarkable case of 'serous apoplexy' following intravenous injections of novarsenobenzol. The patient became comatose on two occasions, the first time 4 days after a dose of 42 cgm.; the second time the day following a dose of 55 cgm. Each time the symptoms were cured by adrenalin, administered intravenously, by the mouth, and intramuscularly. After this the patient was able to bear injections of 60, 70, 80, and 90 cgm. of novarsenobenzol when these were accompanied by intravenous injections of $\frac{1}{4}$ mgm. of adrenalin, and followed by several mgm. given by the mouth or intramuscularly. The adrenalin, in solution of $\frac{1}{4}$ mgm. in 1 c.c. of normal saline, was added to the novarsenobenzol, in solution of

1 cgm. to 1 c.c. of normal saline, and the mixture instilled slowly (10 minutes) by the gravity apparatus. The case presents several points of interest. In the first place the patient was regarded as the subject of Addison's disease, on the strength of extreme asthenia, an earthy tint approaching pigmentation, and the presence of pigmented spots on the mucous membrane of the lower lip. He also had a perforation of the palate in an active stage. Under the above treatment the edges of the palate lesion healed, and the asthenia disappeared. The progress of the case indicates that the Addison's disease, by suprarenal insufficiency, was the cause of the attacks of 'serous apoplexy' following the arsenical injections. These attacks were characterized by progressive rise of temperature, raised arterial tension, and anuria followed by oliguria. The rise of arterial tension is contrary to what would be expected if the serous apoplexy is due to cerebral vaso-dilatation caused by suprarenal insufficiency, and it is curious that adrenalin, which is a vaso-constrictor, causes this hypertension to fall. Milian suggests, as a possible explanation, that the general arterial hypertension is due to mechanical irritation of the nervous centres, by the intracerebral exudation. Adrenalin, by causing disappearance of the cerebral vaso-dilatation, removes the pathological cause of the hypertension and reduces the arterial tension to normal indirectly, without any direct hypotensive action of its own. At any rate, the reduction of arterial hypertension after administration of adrenalin is of good prognosis. This case supports the view that 'serous apoplexy' with coma, following treatment with salvarsan, &c., is due to suprarenal insufficiency, and shows that adrenalin has both a preventive and curative action on this condition.

Sée, however, reports a case in which death took place in spite of adrenalin. The patient, a girl aged 19, had received 5 injections of novarsenobenzol, the last dose being 60 cgms. Ten days later she received 30 cg., which was well borne. A further injection of 45 cg. given a week later was followed on the second day by epileptiform attacks followed by coma and death. Administration of 3 mg. of adrenalin and bleeding to 600 gm. had no effect.

Bory also records a fatal case. After a course of 13 injections of 0·86 cgm. benzoate of mercury, and 4 intravenous injections of novarsenobenzol (0·30, 0·45, 0·60, 0·75 cgm.), a patient with early primary syphilis had an epileptiform attack followed by coma, five days after the last arsenical injection. In spite of bleeding to 500 gm., several injections of adrenalin, lumbar puncture and injection of normal saline, death took place on the third day. The fluid obtained by lumbar puncture gave a positive reaction and contained a small quantity of albumen. Bory regards the case as one of arsenical eclampsia with an incubation of 4 days, epileptiform attacks, coma with mydriasis and absence of meningeal symptoms. He is of opinion that such cases are less exceptional than is generally believed. He mentions another case in which several epileptiform attacks occurred after the second injection of novarsenobenzol (0·30, 0·60 cgm.). This patient recovered and was subsequently treated with large doses of benzoate of mercury (0·06, 0·07 cgm. on alternate days) for a course of 18 injections, after which the Wassermann reaction was negative. The author holds that mercury given in such doses will achieve as good results as arsenobenzol, without the dangers of the latter. He quotes nine other recent fatal cases after injection of arsenobenzol, four of which were due to arsenical eclampsia.

Two new arsenical preparations merit attention—**Sulpharsenol** and

**Silversalvarsan.** Sulpharsenol, prepared by Lehnhoff-Wyld, is composed of the base of 606, and a molecule of acid sulphite of sodium, united by glycol. This preparation has been tried in 33 cases of human syphilis by Levy-Bing, Lehnhoff-Wyld, and Gerbay with apparently favourable results.

The advantages claimed for the new preparation are greatly diminished toxicity, stability of its solutions, perfect tolerance, and great therapeutic activity. The method of administration adopted was that most commonly employed for the other arsenical preparations, viz. intravenous injections at weekly intervals in gradually increasing doses. The doses given were from ·06 to ·90 cgm. The 33 patients treated included cases of primary, secondary, and tertiary syphilis and also tabes. The authors conclude that sulpharsenol in comparatively small doses (·06–12 cgm.) has a rapid cicatrizing action on cutaneous and mucous lesions. In tabes it diminishes the painful symptoms. The therapeutic action appears equal to that of neosalvarsan and sometimes as rapid as 606.

The drug is easily soluble in distilled water (75 cgm. dissolving in 2 c.c. of water), and does not change on exposure to air. Even in concentrated solutions it is said to cause but little local pain when given subcutaneously, or intramuscularly. The general after-effects sometimes observed after salvarsan and its substitutes were notably absent. The authors conclude that sulpharsenol is a promising addition to the therapeutics of syphilis, owing to its ease of administration and low toxicity. The effect on the Wassermann reaction remains to be shown by further observation, but in some of the cases a positive reaction was attenuated.

The other preparation, silversalvarsan, is a German product resulting from Kolle's continuation of the work of Ehrlich and others on combinations of arsenobenzol with various metals. Kolle (*Deutsche med. Wchnschr.*, 1918, No. 43, 44) first experimented with this substance on the syphilis of rabbits, and found it more active than salvarsan and much less toxic. Recently, it has been tried in human syphilis by several German observers. Kreibick, after an experience with 400 intravenous injections concludes that silversalvarsan is superior to salvarsan and less toxic. He gave a series of four injections of 0·3 gm. dissolved in 10 c.c. of sterile distilled water, administered by a Record syringe; the first three injections being given within ten days, and the last after four weeks. No severe side effects were noted, and the Herxheimer reaction was slight or absent. Lenzmann reports good results with doses of 0·1 to 0·25 gm., administered in 20–40 c.c. according to the dose. He had only one severe reaction, with oedema of the glottis after a dose of 0·1 gm., in a series of 250 injections. Hanck also reports good results with doses of 0·1 gm. In a case of tabes dorsalis with pronounced ataxia some improvement was noted after 12 injections. Riecke, however, reports a fatal case, in a man aged 41, after seven intravenous injections. The first five doses were 0·2, and the last two 0·15 gm. After the last injection severe general dermatitis occurred, followed by double pneumonia and death. Haemorrhagic nephritis was found at the autopsy.

**Intraspinal treatment.** Fordyce holds the view that in neurosyphilis the spirochaetes gain entrance to the nervous system at the period of general dissemination, i.e. the florid stage, and that they may remain latent before producing characteristic symptoms of tabes, paresis, &c. This view is supported by the researches of Warthin, who found that in visceral syphilis spirochaetes may be present for years without producing reactive phenomena, also by the results of numerous observers showing that from

25 to 35 per cent. of patients in the first year of infection show pathological changes in the spinal fluid. In some of these patients, after minor damage to the meninges, cerebro-spinal tracts or cells, the infection may spontaneously disappear or be cured by treatment. This is shown in cases of abortive tabes with pupillary changes and slightly altered or absent deep reflexes, with negative blood and spinal fluid. The more usual course is the establishment of foci which progress and eventually lead to one or other of the well-known types of neurosyphilis. Assuming that this view of the early implication of the viscera and nervous system is correct, the importance of its early recognition is evident. Fordyce holds that in the Wassermann reaction we have an indication of the continued presence or activity of the causative factor in some part of the body, and as long as the test remains positive the future of the patient is menaced. He also thinks that a positive reaction remaining for years uninfluenced by treatment is often due to neurosyphilis. 'The blood may become negative after treatment, but is again reinfected by the spinal fluid.'

Fordyce's method of intraspinal treatment is as follows: An intravenous injection of salvarsan is given, and half an hour later 50 c.c. of blood are withdrawn. This is allowed to clot over night in a refrigerator. The next morning it is centrifuged, and the serum is pipetted into a sterile tube. After a second centrifugalization the serum is pipetted into another tube. To this is added the desired amount of salvarsan, namely, from $\frac{1}{10}$ to $\frac{1}{4}$, $\frac{1}{3}$, or in certain cases of paresis, $\frac{1}{2}$ mg. This mixture is then inactivated at 55° to 57° C. for half an hour. To arrive at the proper dosage for intraspinal treatment a dilution of salvarsan is made of which 30 c.c. represents 0·1 gm.; 10 c.c. is then further diluted with 0·5 per cent. normal saline to 35 c.c., of which 1 c.c. equals 1 mgm. of salvarsan. In the administration of the medicated serum a lumbar puncture is made and about 10 to 20 c.c. of fluid withdrawn. A small gravity tube of 40 c.c. capacity is attached to the needle, and the fluid is allowed to flow till it holds about 30 c.c. To this is slowly added the serum, and the mixture allowed to flow back into the canal.

Since using this method of adding salvarsanized serum to 30 or 40 c.c. of withdrawn spinal fluid, and allowing the mixture to return by gravity Fordyce has obtained better results. In this way a larger quantity of spinal fluid is medicated and possibly a positive pressure established. In 75 cases of neurosyphilis of different types he obtained negative reactions many of which remained so for one to three years.

Fordyce concludes that the control of pathological changes in the brain and cord is only possible by repeated examinations of the spinal fluid. We have no definite data of the number of cases of neurosyphilis cured by the older methods of treatment. He is of opinion that few were cured. Hence the need for a more direct method of attacking the spirochaetes in the central nervous system. The intensive use of salvarsan, intravenously combined with mercury and potassium iodide, cures a certain number. All methods of treatment fail in certain types of neurosyphilis because of the inability to reach the spirochaetes in inaccessible places, and because of secondary degenerations which cannot be restored. Intraspinal treatment is successful in certain types which fail to respond to other methods, or which become stationary after a definite improvement, clinically and serologically. Success depends on the technique employed and persistence. In some cases treatment must be continued for one or two years before a definite impression is made on the globulin content or the Wassermann reaction. The cell content is usually influenced first. Rapid changes in the Wassermann reaction when strongly positive in the high dilutions in Fordyce's experience do not occur except in early syphilitic meningitis. In old cases of neurosyphilis a gradual diminution in the intensity of the reaction is of good prognosis, and when finally negative some of Fordyce's cases remained so for one, two, or three years. Arterial syphilis of the brain or cord with a negative serology, or with only an excess of globulin and a low cell count, afford no indication for intraspinal treatment. Early syphilitic meningitis with a high cell count and positive serology gives the best results with intraspinal treatment. Cases of what Fordyce terms 'preparesis', or potential paresis, may, in his experience, be permanently arrested. In such cases arrest of the degenerative process depends on early recognition and persistence in treatment. With regard to tabes, he points out that the distinction between 'pseudotabes' and true tabes is largely artificial. A primary degeneration of the neurones may occur from direct invasion of the posterior roots and columns by the spirochaetes. The meningeal reaction in these cases may be absent or slight and secondary to the neuritis. However, we must conclude that in the majority of cases of progressive tabes meningeal reactions are present. Moreover, the intensity of the reaction is not dependent on the age of the process, for a cell count of over a hundred may occur in tabes of 20 years standing. As regards treatment, advanced degeneration of the posterior columns is, of course, incurable, but symptoms such as lightning pains or crises are due to meningitis, and may be relieved by treatment. Clinically, it is impossible to distinguish pseudotabes from true tabes, as both present the Argyll Robertson pupil, absent deep reflexes, sensory disturbances, &c. The serological findings are a better guide than clinical symptoms. All the classical signs of tabes may be present in a patient whose spinal fluid shows evidence of active meningitis. Stationary or abortive tabes with negative serology does not indicate intraspinal therapy, which should only be used to combat active lesions.

Fordyce emphasizes the importance of examination of the fundus oculi in cases of syphilis, as changes may be present with little visual impairment. In cases of optic atrophy the spinal fluid should be examined, and if this shows evidence of meningitis intraspinal treatment is indicated with the object of arresting the process.

With regard to general paresis, Fordyce states that the probable development of this condition is indicated by failure of intraspinal treatment to influence the Wassermann reaction. Symptoms due to co-existing meningitis may disappear under treatment, but little can be said as to the possibility of permanent cure in deep-seated encephalitis. Limited involvement of the brain with signs in the spinal fluid may exist for years without much effect on the intellectual processes. Intraspinal treatment modifies the course of paresis, and often renders the patient capable of resuming his activities for a time. An illustrative case is described. In all the cases described by Fordyce numerous intravenous injections of salvarsan and intraspinal injections of fortified salvarsanized serum were given ; in one case of 'preparesis' as many as 44 of the former and 69 of the latter, together with several courses of mercurial injections and iodide of potassium. The spinal fluid was examined very frequently, often daily.

**Abortive treatment.** A report was presented to the Paris Academy of Medicine by Balzer, Thibierge and Darier, criticizing an experiment by

Magian, made in March 1918, in which he inoculated himself with exudation from a syphilitic chancre containing numerous *T. pallidum*, and an hour later received an intravenous injection of 0.6 grm. of arsenobenzol. No signs of syphilis followed, and the Wassermann reaction remained negative every month for 11 months. This experiment, in Magian's opinion, tends to show that an early injection of arsenobenzol is capable of counteracting an inoculation with virulent syphilis. The reporters remark as follows: (1) the experimenter may have been refractory to syphilis, the existence of an immunity against this infection, although rare apart from previous infection with syphilis, being accepted by syphilologists of high repute; (2) a single inoculation, although made with great care, may fail, as all vaccinators are well aware. They do not consider that the result of a single experiment justifies its repetition as a general practice after exposure to possible infection, except perhaps in the case of a medical man who has accidently inoculated himself professionally.

Referring to Magian's experiment, Fournier and Guenot hold the opinion that in this case syphilis was aborted, in spite of the reservations of Darier, Balzer and Thibierge. This, they remark, raises the question propounded by Brocq, whether it is justifiable to give intravenous arsenical treatment to persons who have recently been exposed to syphilitic contagion, with the object of aborting possible or probable infection. To elucidate this question, Fournier and Guenot have given intravenous injections of arsenobenzol to forty women who had recent intercourse with persons presenting contagious syphilitic lesions (chancres and mucous patches). There was no evidence of previous infection and the blood test was negative in all the women thus treated, and in most cases no personal disinfection was practised. The treatment consisted in six intravenous injections of arsenobenzol, novarsenobenzol or luargol. The total doses injected were small (1 to 1·20 grm. arsenobenzol; 1·20 to 2 grm. novarsenobenzol; 0·65 to 1 gm. luargol. No sign of syphilis appeared in any of the women and the blood test, repeated four or five times at intervals of two or three months was always negative. One woman, who was pregnant at the time of exposure, gave birth to a normal healthy child. From this evidence the authors come to the conclusion (the logic of which may be questioned) that syphilis may be aborted by arsenical treatment during the incubation period.

**Syphilis and infant mortality.** Though abortions, miscarriages and still-births do not usually figure in statistics of infant mortality, Jeans points out that the consideration of these causes of waste of life is of equal importance. It is also necessary to have statistics of the prevalence of syphilis among adults, and the effect of this infection on the product of conceptions, both by terminating life before or after birth, and by affecting morbidity in the first years of life. The results of a survey by the Wassermann test of adults admitted to hospitals (apart from venereal clinics) in five large cities of the United States showed 9·5 per cent. positives out of a total of 15,264. Vedder obtained 13 per cent. positive reactions in 11,933 recruits for the U.S. Army in 1916, 15 per cent. of 856 candidates for the police force, and 5 per cent of 3203 candidates for commissions in the army. It is worthy of note that in the same locality that gave 5·8 per cent. positive Wassermanns, Warthin found evidence of syphilis in 30 per cent. of post-mortem examinations. Hence Jeans concludes that the minimum of syphilitics in the U.S. is 10 per cent., and the probable percentage 20.

With regard to pregnant women, while the statistics for unmarried women generally show a low incidence of syphilis (3 or 4 per cent.), the percentage after marriage in 5,358 cases examined rose to 9·6 per cent. As regards the effect of syphilis on the foetus, it is well known that syphilis is the chief cause of death of the foetus at or before term. Statistics compiled from 12 authors give the figure of 30 per cent. miscarriages and still-births from a total of 4,148 cases, whereas the figure is only 9·7 per cent. in families with no obvious signs of syphilis. With regard to the percentage of healthy living children in syphilitic families, the combined statistics of six authors give 16·6 per cent. out of a total of 2,450 pregnancies, as against 76 per cent. in families with no obvious syphilis. A survey of early deaths among living births in syphilitic families showed 30 per cent. out of 1,366, as against 15 per cent. in 1,489 healthy pregnancies.

From the above and other evidence Jeans sums up as follows:

1. From 10 to 20 per cent. of adult males and about 10 per cent. of married women are syphilitic, and a minimum of 10 per cent. of marriages involve a syphilitic individual.
2. About 75 per cent. of all offspring in a syphilitic family are infected.
3. In a syphilitic family 30 per cent. of the pregnancies terminate in death of the child at or before term, three times the proportion in non-syphilitic families.
4. 30 per cent. of all living births in a syphilitic family die in infancy, double the proportion in non-syphilitic families.
5. Probably 25 to 30 per cent. of clinically syphilitic infants die as the result of syphilis.
6. About 17 per cent. of all the pregnancies in syphilitic families result in living non-syphilitic children who survive the period of infancy.
7. About 5 per cent. of the infant population is syphilitic.

Jeans quotes Osler's estimation that, including still-births and early deaths of infants, the number of deaths from syphilis at all ages is so great as to place syphilis first among the fatal infections.

In this connexion an article by Thompson is of interest. In 700 autopsies performed for the Coroner of St. Louis, U.S.A. during the last six years, about two-thirds showed gross lesions of syphilis. This series comprised to a great extent untreated and unsuspected syphilis, and the majority of the subjects were of the underworld. The types of lesions found were classified as vascular, parenchymatous, gummatous and fibrotic. Gummata were rare, and the radiating scars of healed gumma more common. Lesions of the stomach were rare, but three types were noted, diffuse scarring of the pylorus, fibrous infiltration of the mucosa, and in one case syphilitic ulceration followed by septicaemia. Intestinal lesions were also rare, and then only as stricture of the large intestine. Lesions of the kidney were also rare, but in some cases there was syphilitic nephritis. In the liver, apart from gummata, there were many cases of cirrhosis with deep lobulations. In the lung there were only three typical cases of pulmonary syphilis. Lesions of the nervous system were common; gummata of the cortex connected with the meninges, and lepto-meningitis. Besides cases of cerebral haemorrhage, there were three of haemorrhage of the cerebellum. The most common lesions were in the heart and blood-vessels, and these were the most frequent causes of death; e. g. ruptured aneurysms, occlusion of the coronary artery, heart-block, myocarditis. Regarding the frequency of vascular lesions, Warthin states that mesarteritis of the aorta occurs in all known syphilitics which come to autopsy, and it has been stated that 22 per cent. of clinical heart disease are syphilitic. Syphilitic aortitis is characterized by thickening or thinning of the wall with loss of elasticity and hyaline changes without much tendency to calcification or atheromatous change, together with linear, radiating contractions or longitudinal rugae. The aortic valves show all variations of lesions. Fibrosis of the left ventricle, hypertrophy, rupture of the ventricle and aneurysm of the heart were frequently found. The writer concludes that despite all the statistics as to the frequency of syphilis we are still ignorant of the real proportion.

**Superinfection.** Klauder discusses the question of superinfection in relation to reinfection. If, in the case of genital lesions appearing in persons with a history of previous syphilitic infection, the spirochaetes are numerous and the Wassermann reaction is at first negative, but later on positive, the evidence is in favour of a primary chancre, or reinfection. But if the spirochaetes are scanty in number and the Wassermann reaction at first positive, the evidence is in favour of superinfection. Such lesions regarded by the author as due to superinfection were papular or ulcerated and not indurated. He considers that many so-called second attacks of syphilis, or reinfections, are cases of superinfection. If evidence of true second attacks of syphilis requires the occurrence of a primary sore followed by secondary symptoms twice in a patient's lifetime, such cases must be rare, and mean that the patient has lost any immunity that may have been conferred by the first attack. Ulceration over a focus of syphilitic lymphangitis in the penis may rarely simulate a primary sore, and must not be mistaken for a lesion of reinfection or superinfection.

**Varia.** Gougerot, Lévy, and Clara report two rare cases of extragenital chancre. In one, 'telephonist's chancre', the lesion was situated on the left side of the upper lip where it came in contact with the telephone, and was apparently due to the instrument having been used shortly before by a person with mucous patches of the mouth, who discharged droplets of saliva charged with spirochaetes on to the edge of the telephone. The other occurred in an army cook, and was situated on the upper gums, and was due to the practice of blowing the fire through a bayonet sheath, which in this case had been previously contaminated. These cases are interesting as examples of syphilis attributable to military service. Telephonist's chancre is important as it might occur in civil life.

Levy-Bing and Gerbay found that out of a total of 2,185 chancres observed in military practice, 58 were extragenital in the following situations: lips, 25; gums, 2; tonsils, 2; tongue, 5; chin, nose, ear, cheek, 1 each; hand, 2; fingers, 5; leg, 1; abdomen, 10; perineum, 2. In 359 patients the chancres were multiple, generally two or three, but in one case ten.

Lévy and Guilé examined the urine of 24 cases of early syphilis for the *Treponema pallidum* with a positive result in one case only. The dates of examination varied from 20 to 60 days after the first appearance of the chancre. Precautions were taken to eliminate confusion with the spirochaetes shown by Noguchi to exist normally in the male genitals, by treating the meatus and balano-preputial mucous membrane with a 1 in 2,000 solution of permanganate of potassium, and by confining the examination to the second portion of urine. In the one positive case two typical specimens of *T. pallidum* were found, one month after the chancre.

As the authors point out, these may have been of renal or general origin, or genital and local. If of general origin, they infer that the end of the first month after the onset of the chancre is the best time for examination. The technique adopted was that of Fontana-Tribondeau.

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C. F. M.

# INTESTINAL PARASITES

Kofoid, Kornhauser, and Plate examined 1,200 men from the United States army, who had been in overseas service, and 300 men from home service troops for the presence of intestinal parasites, and found that infected men were relatively more numerous in the overseas group (798, or 66·5 per cent.), than among those who had only had home service (177, or 59·2 per cent.). With two exceptions, one from Italy and one from Massachusetts, the men with hookworm infection were all from the known area of hookworm occurrence in the United States. There was thus no definite indication of acquisition of the infection. On the other hand, with regard to *Trichocephalus trichiurus*, in home service troops there were 6 infections, or 2 per cent., while in the overseas troops there were 72 cases, or 6 per cent. The increase in infection by *Trichocephalus trichiurus* in overseas troops as compared with that in home service troops is an index of some value of the extent and degree of exposure overseas to faecal contamination of food and water. The most marked contrast, however, between infections on home service and of overseas troops was seen in the case of infections by *E. dysenteriae.* In the former there were 9 infections, or 3 per cent., while in the latter there were 130, or 10·8 per cent. In all cases of infection by *E. nana,* a very common amoeba in man in both overseas (27·1 per cent.) and home service troops (30·7 per cent.), this parasite was differentiated from *E. dysenteriae.* There was little if any selection of cases for examination. The cases were not as a rule dysenteric patients, though many of those carrying cysts of *E. dysenteriae* had had one or more attacks of diarrhoea or dysentery while on the western front. In only a small percentage of cases was more than one examination made. Continued examination for six successive days, as recommended by Dobell, would probably have increased the number of infections detected.

In order to determine the frequency of intestinal worms in Lisbon children Paes examined the stools of 503 children whose ages ranged from under 1 to 14 years. A positive result was obtained in 272 cases, or 54·1 per cent., the ova of the following worms being found: *Trichocephalus trichiurus* in 225, or 44·7 per cent.; *Ascaris lumbricoides* in 97, or 18·1 per cent.; *Hymenolepis nana* in 33 cases, or 6·5 per cent.; and *Oxyuris vermicularis* in 11 cases, or 2·2 per cent. The children were found to be infested by a single parasite or by two or more at once. The most striking fact brought out by the inquiry was the frequency of *Hymenolepis nana,* which is rare in a large number of countries.

Borini examined 3,000 soldiers for tapeworm, which he found in 20, or 0·47 per cent. *Taenia mediocanellata* was present in 18 cases, either alone or associated with *Ascaris lumbricoides, Trichocephalus trichiurus,* or protozoa such as *Megastoma,* or *Lamblia intestinalis. Taenia solium* was found in two cases. None of the soldiers harbouring the tapeworm presented any special symptoms.

In an article on the occurrence of *Trichocephalus trichiurus* in soldiers Hart says that Wolff and Dau in a report to the German War Office stated that this parasite was present in 47·5 per cent. of all soldiers who had been on active service, while in the civil population it was found in only 7·4 per cent. These writers were convinced that *Trichocephalus trichiurus* was by no means a harmless parasite, as two of their cases had severe intestinal haemorrhage for which no other cause could be found but the presence of whipworms, and in 92 per cent. occult blood was found in the stools. Hart's own observations were as follows: In 200 post-mortem examinations on soldiers who had been on active service a positive result was obtained in 84 cases, or 42 per cent. As in the cadaver the parasite lies loose upon the mucous membrane of the caecum, and is very liable to be washed away with the liquid faeces in taking out the intestine, this figure is probably too low, and it is more likely that the parasite was present in at least half the cases. *Trichocephalus dispar* was most frequently associated with *Oxyuris,* though exact figures were not available. In 32 cases it was associated with *Ascaris,* and in only 5 with *Taenia.* In all the cases *Trichocephalus trichiurus* was found only in the caecum, and the appendix was free. As a rule only one or two specimens of the worm were met with, but in several cases a larger number (15–20) were encountered. The presence of occult blood is attributed by Hart to the evacuations of the parasites, whose intestines are filled with the blood which they have sucked from their host. Hart believes that though *Trichocephalus trichiurus* should be regarded as something more than a harmless intestinal parasite, no severe organic disease can be attributed to its presence, and that its significance merely consists in its occasionally giving rise to more or less severe anaemia (vide also *Medical Supplement,* 1918, **1,** 253 *b*; 1919, **2,** 177 *b*).

Moog examined 200 soldiers suffering from various diseases for the presence of *Trichocephalus trichiurus,* and found that it was present in 111, or 55·5 per cent. The number of positive cases increased with the duration of duty at the front. Thus after 4 months at the front there were only 6 cases, after 5–12 months 27, after 13–24 months 31, and after 25 months and over 33. Naked-eye haemorrhages were found in the stools in 14 of the 111 positive cases, or in 12·6 per cent., and occult haemorrhages in 2, or 1·8 per cent. All attempts to get rid of the worms failed.

Warner reports a fatal case of ankylostomiasis associated with Addison's disease in a boy aged 15, who had not been abroad nor resided in a mining district. Numerous ova of *Ankylostoma duodenale* were found in the stools, and *post mortem* a mature ankylostome was seen in the intestine with little or no change in the lining mucous membrane. Extensive tuberculous disease with marked caseation was found in both suprarenals, and was doubtless the cause of death. The boy possibly acquired the infection through association with soldiers who had been abroad.

In a monograph on the control of hookworm disease by the intensive method Howard states that though other drugs have been tested in the work against uncinariasis in the West Indies, thymol remains the favourite anthelmintic. The method used almost exclusively throughout the West Indies is the intensive or weekly dose method, by which a patient is given a dose of thymol on one day each week until he is cured. The dose is based upon 60 grains as the maximum for an adult, and is preceded and followed by an active saline purgative, the patient being required to abstain from food for at least 18 hours during the treatment. In four years' experience in the West Indies Howard found that when the dose was given under these conditions 50 per cent. of the cases were cured by two doses, and that only a small percentage required more than three. Except in a very limited number of cases where the patient indulged in alcoholic drinks or failed to follow directions in some other important detail, no fatality or serious physical disturbance of any kind occurred with the dose mentioned. Thymol is contra-indicated in acute, subacute, and chronic diarrhoea and related conditions, because it tends to aggravate the enteritis present.

According to De Buys, who reports a case in a coloured boy aged 5 in whom there was a history of diarrhoea for nearly a year, there are considerably less than 150 cases of *Balantidium coli* infection in man on record. Men have been infected twice as often as women, and in the cases reported all have been adults, with the exception of three cases in children, including De Buys's case. The usual habitat of *Balantidium coli* in the human being is the large intestine, but it has also been found in the appendix. The pig is the normal host of the infusorium. Necropsies show that the organisms invade all the coats, blood-vessels, and lymphatics of the large intestine and the neighbouring lymph glands, and produce a hyperplasia and cell infiltration either mechanically or through the liberation of cytolytic ferments. Ulcers, which are small and shallow and mostly limited to the mucosa, are formed which are probably due to secondary infection, as the *Balantidium coli* is not found in the wall of the ulcers. Some however penetrate the muscularis mucosae, where they produce a subacute or chronic inflammation of the interglandular tissues and submucosa. Patients suffering from this infection usually have diarrhoea or dysentery. The duration of the disease may be as long as fifteen years. The earlier the diagnosis the better the prognosis. The diagnosis is made by examination of the stools or of some of the blood-stained mucus removed by rectal tube. The mortality, according to Strong, is 30 per cent. Prophylaxis consists in the care and hygiene of those who are in close contact with swine or are engaged in the manufacture of pork products, and in the maintenance of a pure water-supply. In treatment many drugs have been employed, mainly by colonic flushing and irrigation, such as quinine, silver nitrate, iodine, acetic acid, methylene blue, and thymol in olive oil followed by castor oil.

According to Brenner, who records four illustrative cases observed at Kiel, enteritis due to *Balantidium coli* is much more frequent than is generally supposed. In all cases of obstinate catarrh of the large intestine he regards it advisable to examine the stools for *balantidia*, especially as the outlook is very favourable if specific treatment is adopted. This consists in the administration of 1 grm. of powdered ipecacuanha root in the morning on an empty stomach, after a subcutanous injection of morphia or pantopon a quarter of an hour previously. The patient should then be made to lie on his back five to seven hours without eating or drinking. He is given some soup at noon, and a solid meal, if he wants it, at night. If the drug is well borne, it is given for eight days in succession ; if not, on every third or fourth day. If it takes effect and the patient has no more diarrhoea or *balantidia*, the treatment is resumed in another four or five days for two days only, a total of 10–12 grm. of powdered ipecacuanha root being given. The action of the drug is extremely rapid. In most of Brenner's cases after 2–3 grm. had been given, the stools became formed, the *balantidia* disappeared, and the general condition rapidly improved.

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I. D. R.

## DIPHTHERIA ON WOUNDS

During the war a diphtheritic membrane occurred on badly healing wounds both in France and Germany. Also it was noted on the chronic sores prevalent during the Egyptian and Palestine campaigns. The importance of the observation has been found to lie, not so much in the local affection, as in the necessity for finding diphtheria carriers among patients, nurses, doctors, and orderlies.

As for any local complication, it is the same as when a membrane forms on a tracheotomy wound, the membrane requires to be removed to prevent pus being retained underneath. It is prevented from reforming by applying an antiseptic.

The following instance which occurred shortly before the introduction of serum treatment illustrates the foregoing remarks. A house surgeon was circumcising a baby when his nose bled and some drops of blood fell on the circumcision wound. Two days later the baby's penis was much swollen, and around the corona and spreading over the glans was a thick white membrane. The inguinal glands were enlarged, hard but discrete. The membrane was removed; pure carbolic acid applied. The baby recovered and nothing supervened. A discussion as to the origin of the membrane led to an examination of the house surgeon's nose, when some membrane was removed; he recalled having examined a child suffering from diphtheria of the fauces some days before, and he was put to bed. There followed a slowly increasing pain in each mastoid region which increased up to agony, relieved only in part by morphia. Both drums were incised and a little fluid then escaped. The pain slowly subsided; there was no extension to the fauces; hearing was recovered and there were no diphtheritic complications proper. But he was rendered very weak, rapid pulmonary phthisis set in and he died within the year.

In France attention was first called to the matter among Canadian troops. In Germany diphtheria of the fauces was prevalent, especially so at Magdeburg and Kiel. At Heidelberg Wilms the surgeon died of a diphtherial extension to the bronchi at the age of 50, serum treatment having been adopted too late.

In September 1917, Majors Fitzgerald and Robertson found among the men of the Canadian Expeditionary Force who had returned to Canada with still unhealed wounds that out of 67, 40 presented bacilli resembling those of diphtheria. This gave rise to a special inquiry by Prof. Adami and others. Among 306 cases in only 4 were true diphtheria bacilli found, and in only 2 were there bacilli of a virulent character. In none of these did complications due to diphtheria bacilli supervene. In a number of other cases so called diphtheroid bacilli of no special importance were found. There had been other cases in which diphtheria of the fauces had arisen, which were attributed to infection from wounds, but proof seemed to be lacking.

Hartsell and Morris in an American hospital in France observed an epidemic in which 60 wounds became infected. In a single ward 11 cases of true faucial diphtheria were found, and in addition as many diphtheria carriers. The first wound to become infected was a large granulating wound of the thigh which had been under Carrel-Dakin treatment for several weeks. Applications of carbolic acid, also of the cautery, failed to get rid of the bacilli. This was gradually accomplished by applying tincture of iodine and administering antidiphtheritic serum. There were no complications, paralytic or otherwise.

Weinert at Magdeburg, subsequent to his first communication in which he had recorded 14 cases, had noted the continuance of diphtheria of wounds, including wounds made at operations under all aseptic precautions. In Magdeburg and neighbourhood the number of cases of diphtheria of wounds had increased to over 200, involving both military and civil hospitals. Only a bacteriological examination ensured identification. There were no obvious signs on the granulating surface and the patient had not necessarily diphtheria bacilli in the fauces. Conversely, the wounds were not necessarily infected by diphtheria bacilli, although the patient had a diphtherial infection of the fauces. A number of cases operated upon for empyema following influenza, had diphtheria of the wound. Not only were a number of cases termed influenzal proved to present post-mortem evidences of faucial and tracheal diphtheria but the same thing occurred among soldiers on active service. Cases examined after sudden death exposed ulcerating and membranous diphtheria of the fauces.

A number of cases of deaths from heart failure, paralysis of the soft palate, and paralysis of accommodation were explained as following upon diphtherial infection of wounds. In Magdeburg the spread of diphtheria was favoured by overcrowding, the lack of washing of underclothing, and of linen unchanged, whilst it was spread by ill-disinfected wash-basins and baths. Also it was spread by eating and drinking materials; packets of eatables were handed on to comrades by those already infected either by faucial or wound diphtheria. Playing cards and the paper of the clinical notes were similarly infected, and diphtheria bacilli were found under the finger-nails. In this way scratches evoked by lice or scabies tended to become wounds infected by diphtheria. These when covered by a diphtherial membrane, especially when on the leg, were apt to be diagnosed as syphilitic ulcers. Whilst diphtheria carriers were very frequent among adults, there was not in Magdeburg at the same time any special prevalence of an epidemic of diphtheria among the children.

The infection of wounds by diphtheria bacilli is often not obvious, but then the more often that a throat is examined bacteriologically when only a harmless catarrh is all that is apparent, the more often will diphtheria bacilli be found. The wounds which should be examined for diphtheria bacilli are those which are not healing quickly; in which the granulations are glazed and gelatinous. Then diphtheria bacilli may be found not only in a false membrane, but also in the discharge, or in the actual granulations. In such wounds besides micrococci there are also bacilli which must be distinguished from those causing diphtheria.

Clinically the acute cases can be divided into those which present a false membrane and into those in which there is deep-seated induration, indicating a tendency to necrosis, whilst the surface is covered with a greyish layer. The granulations may fungate and overlap the edges, or a fistula being infected the granulations may mushroom out. The serous discharge generally contains diphtheria bacilli. Besides, in the scar adjacent to a fistula, vesicles form containing clear or blood-stained serum and bacilli. The epithelium when detached, exposes a superficial sharply cut ulcer with a greyish surface. Scars of stumps, also extensive scars on the trunk or buttocks are especially liable to suffer. Scars which had been long healed have also been attacked so that a diphtherial infection of scars can be definitely distinguished, as well as the diphtherial infection of previously intact skin. Indeed a pustule has been at first supposed to be due to anthrax until its contents were examined. This is especially likely when there is much surrounding induration, swelling of the lymphatic glands, or oedema of the whole limb. Moreover, the lesions infected with diphtheria may be further complicated by an attack of erysipelas. Besides this there are the cases of severe septic wounds, such as those following amputation and gangrenous wounds which become infected also by diphtheria bacilli. In such cases marked improvement followed treatment by diphtheria antitoxin. In other cases a slowly healing septic wound underwent a relapse, sometimes following a surgical interference such as the making of a counter opening, enlargement of a sinus or sequestrotomy. The diphtherial infection was superficial, and in the cases which succumbed there was generally found a diphtherial infection of the fauces.

Whilst in some cases large doses of diphtheria antitoxin and the local application of the antitoxin to wounds caused a rapid improvement, in other cases no improvement followed. What is necessary is a systematic inquiry into the so-called healthy diphtheria carriers, the cases of larval or latent diphtheria infection.

Of the various applications to wounds the only material which appeared to be of service was acetate of alumina. Besides the cases in which diphtheria complicated septic wounds, it infected scratches in patients attacked by scabies and lice; it also attacked ulcers following nerve injury and sinuses due to tuberculosis and actinomycosis. Then there were operations in which the wounds were attacked, a case of excision of the astragalus, the man having previously suffered from diphtheria of the fauces. There were other instances: a wound following ligature of the left axillary artery, a case attributed to infection through a bath, a completely healed secondary operation to cover over an amputation through the thigh, a wound caused in removing a bullet from the thigh, a suture of the median nerve in which the suture holes were infected. Skin-grafting operations for ulcers of the leg became infected. The wounds and scars following empyema operations were infected in the cases of five nursing sisters and one doctor.

Then there were a number of cases among the wounded who presented paralysis of accommodation, paralysis of the soft palate, or absence of the patellar tendon reflex who had never had any throat symptoms whatever. In the Magdeburg Gynecological Klinik a woman had diphtherial infection of a perineal wound, sutured immediately after delivery; two new-born infants died of diphtheria of the fauces, and in addition a number of adults were attacked. The epidemic was arrested within a fortnight by energetic examination of the fauces and rigid isolation.

Nieter had made cultivations from 497 cases of wounds in the hospitals of Magdeburg and neighbourhood. These were examined in the same way as the cultivations from the fauces, and in 286, i.e. in 58·6 per cent. of the wounds examined, diphtheria bacteria were found. These by various tests were proved to be true diphtheria bacilli. Generally staphylococci, less often streptococci, were cultivated from the same wounds. If *Bacillus pyocyaneus* was present, the diphtheria bacilli were always relatively few in number.

Jacobsohn found in a man who was admitted to hospital 14 days after being superficially wounded by splinters of a shell in the thigh and leg, that the wounds were covered by a false membrane. The patient had also a sore throat which presented a membrane; there was little fever. Diphtheria bacilli were cultivated both from the fauces and the wounds. Under treatment the bacilli disappeared from the fauces 17 days before those from the wounds. Paralysis of the soft palate followed.

Schmidt found that diphtheria of wounds was not accompanied by such an obvious disturbance as is diphtheria of the fauces. The most dangerous complication was the effect on the heart.

Leppmann states that in two cases in which a polyneuritis followed upon wound infection, there was no history of diphtheria affecting either the fauces or the wounds. But the character of the polyneuritis corresponded with that set up by diphtheria. There was a transient paralysis of accommodation which lasted some weeks and then disappeared. This was followed some weeks later by a similar transient paralysis of the arms and legs. The cranial nerves, including those of the soft palate, were not involved.

Anschütz and Kisskalt at Kiel also observed diphtheria of wounds in connexion with epidemics of diphtheria of the fauces.

Donges and Elfeldt reported that there had been no such epidemic in Rostock and yet they had found true diphtheria bacilli in 20 per cent. of infected wounds examined. In these cases the presence of the diphtheria bacilli did not appear to aggravate the infected condition of the wounds; the patients did not suffer generally from diphtheria; the bacilli were never found in pure cultures but with other infective organisms. In none of the cases in which diphtheria bacilli were found in the wounds could such bacilli be cultivated from the fauces. At the same time diphtheria bacilli were discovered in the fauces of a male ward orderly, in a theatre nurse, and a nurse in a children's ward. No relation with diphtheria of wounds could be definitely established, but there was a possible connexion in the case of the orderly.

An epidemic in the hospital at Leipzig, among both military and civil patients, was observed by Läwen and Reinhardt, and they found among 224 wounds examined that 128 showed diphtheria bacilli, 18 cases of fistula following empyema, 15 cases of gunshot wounds, 13 cases of tuberculous fistulae, 3 cases of appendix fistula, 37 cases of bone sinuses after gunshot injuries, 5 cases of sinuses following osteomyelitis and 37 cases of granulating wounds. The bacilli were identified as true diphtheria bacilli, but proved of varying degrees of virulence. A considerable number of those with diphtheria bacilli on the wound were found to have the same bacilli on the intact skin, and some in the fauces. At the same time in 46 other cases, diphtheroid bacilli were found along with pyogenic cocci. Among those with diphtheria of wounds, there were 10 who suffered from diphtheria of the fauces, and in another 15 diphtheria bacilli were cultivated from the tonsils. One of the assistant medical officers engaged in the investigation was seized with acute diphtheria of the fauces and died in 3 days.

Lt. Col. C. J. Martin, among his observations of the chronic sores occurring among the Australian cavalry campaigning in the desert to the east of the Suez Canal, noted one case in which the *Bacillus diphtheriae* was found, whilst diphtheroid bacilli were not uncommon.

Walshe in his observations definitely advanced the proposition that cutaneous diphtheria might be itself a cause of paralysis, the peculiar paralysis being a local paresis anatomically related to the infected focus. In a series of 30 cases a local paralysis occurred in 8 cases, a paralysis of accommodation in 10, and a polyneuritis in all. The local paresis was in 6 associated with a single sore, the remaining 24 of the 30 had multiple sores. He cited the case of a medical officer who, in performing tracheotomy on a case of laryngeal diphtheria, scratched his right thumb; a small ulcer formed, from which the *Bacillus diphtheriae* was grown. During convalescence there occurred numbness and paraesthesia of the right thumb, weakness and clumsiness of hand movements, and cramp in the hand and forearm. Upon these supervened polyneuritis of moderate severity. There was no palatal paralysis or paralysis of accommodation.

Crowe appeared to conclude that the diphtheroid bacilli found on septic sores and boils in Egypt in about 5 per cent. were secondary, imposed on streptococcal lesions. Craig found diphtheroid bacilli in 129 out of 197 sores examined. Diphtheria, both of the throat and nose, was prevalent among the troops, but of a fairly mild type. He considered that the diphtheroid bacilli which did not conform to the Loeffler bacillus standard were, however, immature forms. Hence the importance of diphtheria antitoxin, which he regarded as an absolute specific for the chronic sores he observed. He suggested that the diphtheria bacillus might have a saprophytic existence in horse-dung. In his opinion it might be a primary local infection, not as Crowe had held a secondary one, and the direct cause of some septic sores. Being generally of low virulence it produced paralytic complications in only a few susceptible individuals.

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W. G. S.

## HALLUX VALGUS

Hallux valgus, so far as it is amenable to surgery, is an acquired deformity, produced by wearing wrongly-shaped boots in early life. The attention of those having the care of children should be directed to the feet of children who go barefoot. When standing, the great toe will be seen in line with the inner side of the foot, or indeed pointing inwards a little, so as to be slightly abducted, and this slight abduction is increased when the child is on tiptoe. Children whose hands and feet grow longer than the average are supplied with boots of the length dictated by the seller, or, when they are growing fast, the boots become too short before being worn out.

Fashion dictates to the young adult boots pointing over the third toe in the middle of the foot. Short people with short feet, for whom the boots would be sufficiently long, adopt high heels by which the foot is driven forward. Thus the toes are pressed together toward the third toe and middle line of the foot, the great toe overrides the second, which, as the farthest projecting toe, becomes flexed, and the deformity of hammer toe complicates that of hallux valgus. The great toe ceases to bear the stress in walking, and so undue weight is thrown upon the inner side of the foot. Thus flatfoot is produced and the great toe tends to twist outward on its long axis as well as being turned outward to an angle of 45° or more with the inner side of the foot.

When the deformity is established, the abductor hallucis, together with the inner head of the flexor brevis hallucis, and the internal lateral ligament of the metatarso-phalangeal joint are stretched. The structures on the outer side, the adductor obliquus hallucis and the outer head of the flexor brevis hallucis, together with the transverse metatarsal ligament, are shortened and resist the correction of the deformity. The continuance of the deviation outwards produces in the metatarso-phalangeal joint changes characteristic of osteoarthritis deformans, flattening by pressure, atrophy of the outer side of the head of the metatarsal and base of the first phalanx, osteophytic outgrowth on the inner side. Pressure over these osteophytes induces an adventitious bursa in the subcutaneous tissue which communicates with the joint through the internal lateral ligament. As the deviation of the toe outward progresses the long extensor and long flexor tendons, instead of pulling in the long axis of the toe, act as bowstrings in bending bows, and aid in increasing the deformity. Surface irritation over the bursa and the osteophytes thickens the skin, and keeps up inflammation until microorganisms penetrate, when there is suppuration in the bursa, then in the joint, followed by necrosis of the ends of the bones.

Hey said that when the caries was confined to the head of the metatarsal bone it had been usual to saw off the carious part. But as it was sometimes difficult to ascertain the extent of the caries he thought a more advantageous operation was the amputation of the great toe at its junction with the internal cuneiform bone. The necessity for this amputation has often arisen since Hey's recommendation, especially in neglected hospital cases. But the more general operation has been excision of the head of the metatarsal together with the sesamoid bones and the bursa before suppuration has supervened. The result is usually that the patient has a painless flat foot with which many occupations can be followed.

Can this excision be avoided ?

In early cases in young people, the toe may be moved freely under gas to free it from small adhesions, and then exercises with the bare feet, rising on tiptoe and standing on the outer side of the feet, will overcome the flatfoot and strengthen the structures on the inner side, including the abductor hallucis. If square-toed boots with low heels are worn, the deformity will be arrested.

Pads of wool or of rubber between the first and second toe, a division or 'toe-post' in the boot or sandal, an elastic band on the inner side and around the base of the first phalanx, making extension in the line of the abductor hallucis, all have the indirect advantage that they render square-toed boots necessary. But such measures are generally troublesome, do little good, and take off attention from the important exercises.

Small operations mostly prove insufficient, excision of the bursa, shaving off the osteophytes, the advancement of the insertion of the abductor hallucis as recommended by Fuld. Tenotomies may perhaps allow of a temporary reduction of the deformity, if made freely enough on the outer side, but fail to prevent relapse.

Osteotomy of the metatarsal in various directions has been tried, but the operations were difficult to carry out properly before the introduction of the electrically driven wheel-saw. Using this saw, oblique osteotomy through the distal third of the metatarsal beginning from behind and above, and sloping forwards and downwards to the under surface at the junction with the head, has been carried out by Ludloff.

Ludloff's description is as follows: An Esmarch band is applied to render the operation bloodless, and the foot is laid on its outer side. An incision is then made along the inner side from near the base of the first metatarsal bone, over the bunion and the joint as far as the first interphalangeal joint. The skin incision is well retracted. Next, commencing near the base of the metatarsal, a flap which includes fascia, muscle, periosteum, wall of the bursa, and capsule of the joint is raised from behind forwards beyond the metatarso-phalangeal joint, where it remains attached by a broad pedicle to the base of the first phalanx. The breadth of this flap reaches to the long extensor and flexor tendons, but these are retracted and preserved from injury. Following upon this a spatula is thrust through the first interosseous space close to the metatarsal bone in order to protect the soft parts from the saw. The wheel-saw is now applied to the inner side of the metatarsal bone so as to cut it through in a line running from above at the junction of the middle and distal third of the bone to the junction of the shaft with the head below. The bone divided, parrot-bill rongeur forceps are used to trim into shape the head of the metatarsal and the base of the first phalanx by nibbling away the osteophytes. Any angles of bone made by the osteotomy cut which prevent reduction are also removed, until the deviation can be a little over-corrected. This abduction is then kept up by stitching down the fascial-periosteal flap again to the metatarsal bone near its base. Any excess of thickened skin may be pared off. If the haemostatic band recommended by Ludloff is dispensed with, all bleeding should be stopped by ligatures and buried sutures, after which the skin is united. The foot is put up on a soleplate with pads to keep the great toe in position.

Ludloff's paper is illustrated by a number of photographs, including X-ray photographs, taken before and after operation, as well as of drawings describing the details of the operation. The immediate results have proved satisfactory, union occurs and the long extensor and flexor tendons now pull in the long axis of the toe.

In Germany Ludloff's operation has been tried and approved by Simon. His method appears to have given better immediate results than any previous osteotomy or cuneiform excision. It remains to be seen whether late results show improvement over excision of the head of the metatarsal.

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W. G. S.

# THE ANALYSIS OF INJURIES PRODUCED BY FALLS FROM GREAT HEIGHTS

The consideration of the injuries produced by falls from great heights is not a useless task, whatever its complexity. Specimens of necessarily fatal injuries which have occurred during the war are being preserved in museums because it is anticipated that study of such specimens will afford knowledge of use in the treatment of injuries less fatal in character. The body of an airman killed by such a fall interests the coroner and his jury so far as it is necessary in order to assign a cause of death. The principal matter is the engineering question, what happened to the machine? Could this have been prevented? May it be prevented? The medical officer or civil practitioner called from the midst of his day's work recognizes at a glance some one or more fatal injuries, which is all that will be required of him by the coroner. It is not that hospital practice is any better. A man who has fallen from a scaffold is brought to the hospital, where the casualty house-surgeon finds him dead and notes one at least obvious injury which was necessarily fatal. He then directs the body to be taken to the mortuary. The coroner's officer ascertains from the house-surgeon that his evidence is likely to suffice for the coroner and jury. Even if the coroner orders a post-mortem examination, the main object of that examination is to establish one cause of death. Occasionally the pathologist finds some extraordinary injury which may ultimately find its way into a museum. But there the lack of information regarding the character of the fatal accident renders it likely that the specimen will rank with the marvellous rather than with the useful.

The methodical examinations and descriptions made by Anders on two cases are reproduced below, chiefly as examples of a better way. The injuries were not of such complexity but that at any rate some analysis can be attempted. A few preliminary remarks may be made concerning the terrific velocity attained in such falls. In the two cases to be described the men fell clear of the aeroplane, so that there were no injuries from crushing or burning. Before coming in contact with the ground there were possibly injuries, due to the partial vacuum produced, similar to what has occurred in typhoons and in the discharge of high explosives. Air in the intestines and other cavities rapidly expands, gases escape from the blood and other fluids. Lacerations of the skin occur from bursting.

The first part of the body which touches the ground comes suddenly to rest, whilst the several parts of the rest of the body continue to fall. Suppose the body to touch the ground with the head or shoulders and to be momentarily upright, then the fall of the rest of the body will be in the direction of the head, in the long axis of the trunk and limbs. A long bone fracturing the lower fragments will telescope on the upper; if the fracture is comminuted, fragments may be driven up the soft parts headwards. The abdominal contents will fall towards the thorax, the organs of the thorax towards the neck, the brain will be dashed against the part of the skull which first touches the ground. Such a body has been driven head first straight into the ground, but with any lateral direction it will topple over so that in rapid succession different points of the body will come into contact with the ground only a little less violently than the first point. Thus, if it topples to the right side, then the shoulders, arm, chest, side of the pelvis and thigh will be arrested whilst other parts will be moving forcibly to the right. When a man falls on his right side and fractures a rib owing to contact with the curb or because the bones of his arm are interposed, then it is said that the fractured rib is driven into the lung. But the injury may be described from the opposite point of view—part of the rib is arrested by the curb whilst the rest of the thoracic wall continues to fall to the right until a fracture occurs. The lung is also falling to the right, and in its turn becomes impaled upon the fractured ends of the rib. In such a fall to the right the liver is driven against the lower ribs. Supposing a fall on to the back, the spine is arrested, and the liver, continuing to fall backwards, strains upon the falciform ligament so that it ruptures.

But the body, from standing on its head, may be violently bent. In a fall over a horse's head the head and shoulders are arrested by the ground whilst, the rest of the body carrying on, there is formed an acute bend of the cervical or dorsal vertebrae convex backwards.

When on the stage an acrobat turns a somersault so as to land again on his feet, there is at one moment a strong bending of the spine concave backwards. With greater force a diastasis of the vertebral bodies is produced, just as when a man falls, back downwards, across a rail.

Moreover, violent compression has the effect upon the fluids and semi-fluids of the body which is illustrated by the experiment of firing a bullet into a sealed beef tin. An explosive effect is produced which has been described in connexion with a bullet penetrating the skull, but applies equally to walled-in fluids and semi-fluids elsewhere. This is particularly noteworthy in connexion with extravasations of blood from out of the blood-vessels—the places where blood is not extravasated as well as the localities infiltrated.

For the purposes of a methodical examination, a commencement must be made before the dead body is touched, so that a note may be taken of its position and of distortions of the limbs. At the same time the ground around should be inspected for evidence of bloodstains, rebounds, or for objects which have separated from the body. Before transporting the body from the spot the rents and tears of the outer clothing and headgear need to be examined, also the parts of the clothing smeared with soil, the parts of the outer clothing into which soil has been driven, the depression in the ground in correlation with the position of the body.

The post-mortem examinations should begin with the inspection and methodical removal of the clothing so as to note rents in relation to the material and the seams, the staining of the outer or inner clothing with blood or other body fluids. When the corpse has been stripped, the oozing of blood from orifices, abrasions, lacerations, and ruptures by bursting are to be observed. The discoloration by subcutaneous effusion, the collection of blood underneath the skin, the peculiar wide separation of the skin from underlying subcutaneous tissues and muscles, and surgical emphysema require to be noted before proceeding to open the body. The distortion of the limbs must be recognized before touching the body, for in the transport to the mortuary alterations are inevitable.

The accident which caused the death of the two cases now to be described began, according to onlookers, with the aeroplane at about the height of 2,000 metres turning sideways, then over and over some twenty times. At about the height of 1,500 m. the observer fell out, and in falling struck a quite young and low pine-tree; then he pitched on his head and right side, making a slight depression in the ground. At about 1,000 m. the aeroplane broke a wing, then it descended in very narrow spirals, and at about 10 m. from the ground the pilot separated from the machine. He was found lying 6 m. away on his back. He was seen to make some gasps and movements of the eyelids, but in about 1½ minute was dead.

*Case I. The observer* had fallen from about 1,500 m. and the right side of his head and then the right side of his body came into contact with the ground. The helmet was split open, beginning from over the right ear across to the left ear; the whole of the right side of the helmet was driven in and discoloured by soil. The right ear-guard of leather, buckled under the chin, was torn across. The stout band of the goggles was also torn across over the left zygoma. The hairy scalp, face and neck were covered with clotted blood. On moving the head dark red, thin, bloody fluid escaped from the mouth, nose, and both ears. The whole of the left half of the skull appeared as if it had been driven backwards. The left eyelids and surroundings were discoloured blue and black and were closed over a sunken-in orbit; on separating them the eyeball was seen displaced back but unruptured, the iris being surrounded by a ring of subconjunctival haemorrhage. The pupil was not distorted. Over the right ear was a sharply-cut wound of the scalp, 3 cm. in length, which had bled apparently freely. Palpation disclosed that the scalp was freely movable, having been widely raised from the frontal bone, and that the frontal bone presented several gaping fissures around a large triangular piece of the frontal squama. This and the neighbouring pieces of bone could be within limits shifted about and over one another, and were only retained in their position by the hairy scalp. The mastoid portion of the right temporal bone had been broken into numerous loosely connected fragments, some of which had been driven inwards.

When the scalp was turned back a quantity of dark red bloody fluid flowed out from the left ear. The right side of the scalp covering the frontal, parietal, and occipital bones was the most infiltrated by blood. A three-cornered piece of the frontal squama was detached, so that when the scalp was turned down it fell to the ground. Then it could be seen that the brain had collapsed and sunk back. The dura had been widely opened, beyond what was then in view. Both frontal lobes were lying free; the dura had been torn away from the crista galli. In the cortex of the left frontal lobe were embedded many large and small splinters from the inner table. The surface of both hemispheres was covered with dark blood. In the roof of both orbits, especially the left, there were numerous fissures running towards the lamina cribrosa, along with several separated splinters, partly overriding one another. Starting from the region of the foramen magnum a fissured fracture passed forwards on the convexity of the skull towards the left ear, where it met at right angles a second fissure running from the left-hand angle of the above noted three-cornered gap in the frontal bone. From that point the first fissure was continued forwards partly in the squamosal suture until it reached the coronary suture which had sprung widely apart. Parallel to and above this another fissure ran through the left parietal eminence. Both temporal muscles were discoloured a dark red and infiltrated with fluid. The external auditory meatus on the right side was full of clotted blood; the depressed portion of the right mastoid process and neighbouring temporal bone presented numerous radiating fissures, two running up towards but not reaching the sagittal suture. When the saw was applied to remove the calvarium it fell to pieces, and there were then visible fissures prolonged towards the base, especially in the region of the frontal bone. The brain had lost all structural and topographical distinctions; it was a chaotic medley of blood-clot, remnants of the tentorium, portions of brain and fragments of bone, the description of which was both impossible and without object. Both frontal lobes and the right temporal lobe were completely smashed and mixed with blood. Both lateral ventricles contained blood. The brain substance, which had been partly preserved, was extraordinarily soft.

It would seem, therefore, that contact with the ground was first made at the frontal squama on the right side, where the triangular piece was separated. There the momentum due to gravity was arrested, whilst it continued to act on the left half of the skull, and that part travelled backwards. In addition, the sudden increase of pressure on the semi-fluid contents of the skull produced a bursting effect acting in all directions. But in this case the result of bursting does not appear marked.

No fracture of the bones of the face was noted, but the mandible was fractured in the region of the right mental foramen and there was a wide gap, the two fragments moving freely on one another. The cervical vertebrae were intact, but on both sides of the neck, from the mastoid process to the thyroid cartilage, there was a band, discoloured, bluish red, marking strangulation, such as is known to legal medicine in deaths by hanging. There was no fracture or dislocation of either clavicle.

It is evident, from the following description, that after the right frontal region, contact with the ground was next made by the right shoulder. Hence the fracture of the mandible and the signs of strangulation in the neck may have been produced by bending of the neck to the right whilst the neck was encircled by the collar. From the right axilla to the lower margin of the ribs there was surgical emphysema. On the right side below the axilla, the third to the sixth rib had been displaced inwards, resembling a funnel-shaped depression of the sternum. The skin over this showed superficial abrasions and haemorrhages. There had been a fracture of the neck of the humerus, also of the acromion process, and the separated head was displaced downwards and forwards into the axilla. The skin over the arm showed abrasions and the humerus was broken in many places. There was also a rent in the skin, 3 cm. in length, with smooth edges. The right forearm was fractured a handsbreadth above the wrist, and the end of the upper fragment of the ulna protruded through a hole in the skin the size of a mark-piece. Quite near it there was another perforation through which protruded the upper fragment of the radius. The semilunar and cuneiform bones had been pulverized, but the skin over them was undamaged. The fourth and fifth metacarpal bones were comminuted into many pieces, the distal phalanx of the fourth finger was hanging by a bit of skin, and on the palmar surface of the above metacarpals the skin showed stellate lacerations. These injuries were produced by contact with the ground in succession from the outer side of the head of the humerus down to the ulnar side of the pronated hand. With these may be compared the condition of the left side and left upper extremity.

The ribs on the left side of the thorax were intact; the left shoulder and arm showed no injuries except some superficial abrasions. The left forearm in pronation presented a marked diminution in its lower half; it could be felt that the radius was fractured in the middle of the shaft, but the skin was intact. The upper end of the lower fragment lay under the intact ulna. The styloid process of the ulna was prominent, the head seemed broken off. The styloid process of the radius lay deeper and was situated 1 cm. above its normal level. The hand had been displaced towards the radial side. The small bones of the hand were not injured. The spine in the dorsal and lumbar regions had escaped.

Turning to the examination of the chest and upper abdomen, the subcutaneous tissue of the right pectoral muscles was markedly infiltrated with blood. On exposing the funnel-shaped depression it was found that the first to the fourth ribs were fractured at about 1·5 cm. from their cartilages and were directed inwards, whilst the clavicles, sternum, and left ribs showed nothing wrong. In the right pleural cavity there were about 200 c.cm. of fluid blood. On the back wall in front of the first to the third rib there was extensive subpleural haemorrhage. The pericardium on the right side from the diaphragm up to the level of the root of the right lung had split open exposing the fat on the surface of the heart. There were some 20 to 30 c.cm. of fluid blood in the pericardium; the heart-muscle was pale, but there were no haemorrhages into it; the large vessels joining it, the valves, papillae, and chordae tendineae were intact. The right lung presented on its outer and posterior surface many rents, the middle lobe had become an unrecognizable pulp of blood, a bit only remaining connected with the hilum. Both upper and lower lobes were infiltrated with blood and showed a diminished content of air. The right main bronchus and the blood-vessels at the hilum were entirely unharmed. Besides the anterior fracture, the ribs from the first to the fifth were fractured between the heads and the posterior tubercles, and some of the ends had penetrated the parietal pleura. The result of these fractures must have been an instantaneous diminution of the content of the upper part of the pleural cavity by one half. The right half of the diaphragm was intact. In the left pleural cavity was blood-clot with about 500 c.cm. of bloody fluid. All the ribs on the left side had been fractured at about 2 cm. from their heads, and some of the ends had penetrated the pleura; there was no dislocation proper. On turning forward the left lung there was exposed in the descending aorta, at the level of the hilum of the left lung, a rupture 3 cm. in length, which ran in a spiral fashion on the left side of the vessel, so as almost to divide the artery, the lumen of the artery appearing particularly narrow. There were no other injuries to the vessel, no rents in the interior, and there was no evidence of previous disease. The posterior part of the left lung had been reduced to a pulp, but the bronchus and vessels at the hilum were not torn. The left internal jugular vein was distended to the size of the little finger and the surrounding connective tissue was infiltrated with dark red blood. The subclavian arteries and veins were untouched and there were no lesions of the intima in the carotids. The whole of the posterior mediastinum was infiltrated with blood. The hyoid bone, larynx, and trachea had escaped injury.

The injuries to the upper limbs and chest may be traced to the body coming into contact with the ground by the right shoulder, arm, and forearm, the fall of which became arrested in succession. The momentum affecting the chest and its contents continued in violent action towards the right, hence the upper ribs of the right side were arrested by the head of the humerus, and in its turn the middle lobe of the right lung was dashed against the fractured ribs. Falling force acting in the long axis of the body headwards would explain the fracture of the left forearm, also the rupture of the thoracic aorta and the distension of the internal jugular owing to some of the thoracic viscera being propelled towards the neck. Anders put forward another explanation of the rupture of the aorta, viz. that at the moment when the content of the thorax was suddenly reduced the aorta was distended by a cardiac systole, and the added external compression then caused it to burst.

The abdomen and scrotum were noted to be distended by gas. The breeches of strong material were split in the seam of the fork and on the inner side of the thighs for 25 cm.; also the pants, and smelt strongly of urine. Whilst the vertebrae were not fractured, the two innominate bones moved freely on one another at the symphysis. The scrotum and inner side of the thigh were covered with faeces mixed with urine. There was a rent in the perineum, running from the scrotum into the anus through the external sphincter. The urethra was cut across in its membranous portion. The left leg was rotated outward and shortened by 4 cm., the left popliteal space was coloured a dark blue and the front aspect of the knee was ballooned out. The skin of this region had been widely separated from the subcutaneous tissue, which was infiltrated with blood. This separation was continued over the outer side of the leg so that the shortening of the limb had thrown the loosened skin into folds. There was a T-shaped fracture of the lower third of the left femur into the knee-joint; the anterior crucial ligament was ruptured but not the posterior. But there was no fracture of the left leg and foot. The right lower limb had not been fractured.

On laying open the abdominal cavity, gas from the stomach escaped and remnants of food were found among the coils of the small intestines. On the great curvature of the stomach close to the pylorus was a rent the size of a 5-mark piece. In the pouch of Douglas were some 50 c.cm. of bloody fluid. The left half of the wall of the pelvis was infiltrated by blood and gas. Pressure on the scrotum drove up much foul gas. There were several deep rents in the spleen, and blood was extravasated around; the spleen was softer and larger than normal, which was attributed to an antityphoid inoculation a fortnight before. Contents of the stomach had spread between the liver and diaphragm, and parallel to the falciform ligament were two rents running from the edge deep into the substance of the liver. The gall-bladder was empty and had a slit in it 1 cm. in length. Beyond being distended. the intestines were intact. The kidneys, ureters, and bladder were also uninjured, except that some blood was extravasated around the right kidney. The pubes had been fractured in the region of the symphysis, but the skin was uninjured.

The right side of the pelvis had come in contact with the ground and the continuance of the momentum to the right affords an explanation of the fracture of the pelvis and the abdominal injuries. The gas in the intestines would have expanded, owing to the vacuum during the fall, and would therefore be a factor in the extravasation of faeces and urine, the rupture of the perineum, and the distension of the scrotum. The fracture of the left femur into the knee-joint, along with the wide separation of the skin above and below the fracture in the limb which reached the ground last, point to the force of gravity acting in the long axis of the limb; the condyles of the femur split apart and the semi-fluid soft parts moved violently towards the head underneath the more resistant skin, which was thus thrown into folds.

*Case 2. The pilot* lay on his back. His helmet was indented behind and smeared with soil; the seam down the middle of the back of the leather jacket was split open with several rents running out from it. Underneath the left breeches pocket there was a stellate tear the size of a 5-mark piece; over the right buttock both the breeches and pants were split open and blood-stained; the buttock itself was bruised. On taking off the left shirt-sleeve, there fell out a loose piece of the ulna 8 cm. in length.

The face was covered with dried blood, and dark red fluid blood escaped from the mouth and nose. The skin over both zygomas had been bruised by the goggles. From the outside no fracture of the skull was noticeable. The mandible had been fractured in the middle and the right half displaced backwards on the left. Also the right maxilla had been moved backwards and the hard palate fissured. There was a fracture of the cervical vertebrae with rotation and bending of the head back, and on each side the neck showed abrasions and infiltration by blood. There was marked surgical emphysema over both supraclavicular fossae. Both clavicles had been comminuted and the fragments displaced. The first three ribs were fractured in many places, but the sternum and left side of the thorax were not injured. The shaft of the left humerus was fractured in many places. The extensor aspect of the left elbow-joint presented a tear 4–5 cm. long, in which lay loose a displaced fragment of the ulna. It was from this wound that the fragment of ulna found loose in the sleeve of the shirt had made exit. The left forearm and hand, also the right upper limb, had escaped fracture. There was no sign of a fractured pelvis, but on the left side of the scrotum was a split 3 cm. in length parallel to the raphe, out of which protruded the left testis covered by the tunica vaginalis, and with the veins of the pampiniform plexus engorged. There was also a rent in the middle line of the scrotum at the root of the penis, and the rest of the scrotum was infiltrated with blood. The left femur had multiple fractures and on the outer side of the upper third a rent in the skin with sharply-cut margins through which the muscles of the thigh protruded to the size of a small apple. The limb lay rotated outward and shortened by 4 cm. The left leg and foot were unharmed. The right thigh and leg presented a number of simple fractures, with the skin loose on the outer side and folded. The scalp in the occipital region was infiltrated by blood-stained fluid. There were no fissured fractures of the calvarium. Between the skull and the dura mater there was a widespread haemorrhage, especially on the right side over the fissure of Rolando. The dura mater was tense from blood underneath, which escaped when the dura was laid open, and had become spread over both the hemispheres and the cerebellum. The brain was not lacerated, but on removing it there was much blood-stained fluid in all three fossae. Then there was found a fissuring of the base extending from the left side of the crista galli, through the optic foramem, foramen rotundum, ovale, and spinosum of the same side, through the left pars petrosa and the internal auditory meatus.

The examination of the thorax disclosed marked infiltration of the right pectoral muscle by blood, and beneath it, mixed with blood, bulged the apex of the right lung. The first three ribs had been fractured in the anterior axillary line and bent inwards. Between the sternum and the inner end of the right clavicle was a gap of 3 cm. On removing the sternum each pleural cavity was seen to contain 200–300 c.cm. of blackish red fluid blood. The anterior mediastinum was infiltrated with blood; both lungs, and especially the upper lobes, had been smashed and mixed with blood, but the bronchi were not lacerated. The pericardium had burst on its left side for the length of 6 cm., and the cavity contained a few c.cm. of fluid blood. The aorta had been torn across just above the bulb and the distal end had retracted upwards about 1 cm. There was a ragged hole in the right auricle the size of a 2-mark piece. The pulmonary vessels and the venae cavae were intact; also the cardiac valves and chordae tendineae. There was a wide rupture in the diaphragm on the left side, through which the stomach as far as the pylorus and omentum had passed into the pleural cavity, the stomach itself not being injured. A further examination of the neck showed that, whilst the hyoid bone and the thyroid cartilage were intact, the rings of the lower half of the trachea had been fractured, each ring in two places behind on either side of the membranous wall; the mucous membrane was perforated and the surrounding tissue infiltrated with blood. There was a large haematoma in the posterior mediastinum. Between the last cervical and first dorsal vertebrae there was a large wedge-shaped gap extending to the spinal canal. Out of this gap hung down into the pleural cavity the cervical spinal cord, which had parted about the level of the second cervical vertebra. The cord was not altered, except that it was bruised at the acute curve over the first dorsal vertebra. Above that the spinal canal was empty, the cord having been drawn out by tearing through the anterior and posterior roots.

In the abdominal cavity it was noted that the intestines were distended; there was a quantity of fluid blood between the liver and diaphragm which reached up to the eighth right rib. The liver, which had been displaced backwards, showed two parallel fissures, 3 cm. in length, close to the falciform ligament, and there was a rent in the parietal peritoneum under the ribs the size of a 5-mark piece. The gall-bladder was distended but intact. The spleen in the left hypochondrium had been reduced to a bloody pulp. The capsules of the kidneys were infiltrated with blood and there were fissures running out from the hilum into the parenchyma of each. The adrenals, pancreas, and pelvic organs were uninjured.

From the above description it is clear that in the second case the back of the head came first into contact with the ground. Then the momentum of the rest of the body in falling so as to come to lie on the back caused a forced bending backwards of the spine at the junction of the last cervical and first dorsal vertebrae which tore out the cervical spinal cord and its roots and fractured the clavicles. The momentum of the facial bones caused the maxillae to be carried backwards and the base of the skull to be fissured. The viscera of the thorax showed the effect of displacement upwards and backwards,—the apex of the right lung driven underneath the pectoral muscle, the aorta torn through from the more fixed base of the heart; the peculiar fracture of the trachea suggests a force acting towards the head.

If the intestines were distended by the expansion of air owing to the vacuum produced in falling, the sudden displacement backwards and towards the head would account for the rupture of the diaphragm on the left side and the rents in the region of the falciform process of the liver. The scrotum must have been distended by increased abdominal pressure acting on the pelvic floor. Hence the rent and the protrusion of the testis.

The methodical description by Anders admits of a comparison being made between the two cases. The intercalated explanations are no doubt quite inadequate. A number of such accidents must be examined in the same fashion before any general principle can be established. The suggestion made is that an analysis of such injuries is both possible and useful.

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W. G. S.

## PROSTATECTOMY, SUPRAPUBIC AND PERINEAL

Suprapubic prostatectomy, by the method first described in 1901 by Freyer, has been in his hands most successful. In 1912 he reviewed 1,000 operations; early in 1919 he had added 550 more. In his first 100 cases the mortality had been 10; in the last 200 cases it had been reduced to 3 per cent. Altogether, in the 1,550 prostatectomies, death had followed in 83, i. e. 5·5 per cent. The ages had ranged from 48 to 90 years, an average of 69; 89 cases had been aged between 80 and 90, with 13 in their 80th year, and among these there had been 12 deaths; 274 cases had been complicated by calculi, with 21 deaths, i. e. 7·5 per cent. In 1913, Freyer reported that among 1,276 cases of prostatic enlargement, he had diagnosed 1,105 as benign and 171 (13·4 per cent.) as malignant, one being sarcomatous. He had undertaken removal when deemed operable by his procedure, and he quoted 8 successful cases. As to the later course of more than 1,100 cases after removal of supposed benign tumours, he had not learnt of cancer supervening in more than half a dozen patients.

Very much has been written on the subject of late years, especially in America, but also in this country and in France and Germany. It would appear that experience everywhere leads to the same conclusion, that to attain to the success reached by Freyer there must be a rigid selection of cases. Outside of the select cases complications arise which induce a mortality of 15 to 25 per cent. Hence attention has been directed to the prevention of these complications. The smaller and the harder the prostate the greater is the danger by the suprapubic route; in a residuum of cases perineal operations are preferable. If the cases are dismissed as inoperable or treated in other ways short of removing the prostatic tumours, the duration of life is but short, owing to the continuance of retention and its sequelae. It is the object of this review to describe briefly the prevention of the complications attending suprapubic prostatectomy, and the indications for the removal by the perineal route when the risk by the suprapubic operation is considerable.

**Historical and anatomical preliminaries.** There were surgeons who can be recalled, well acquainted with the anatomy of the perineum, yet ignorant of pelvic anatomy. They practised perineal lithotomy with great skill, and their failures may be traced to the sepsis they were instrumental in introducing. Now it is the reverse, for the most frequent objection raised to perineal operations is that they lead to errors of technique, owing to the operator not having acquainted himself with the anatomy of the region. Modern perineal operations stand in direct continuity with the methods devised by lithotomists. In order of date there was the operation of the 'apparatus minor', described by Celsus as practised by the Alexandrians—the stone hooked down by the finger in the rectum—a semilunar incision across the centre of the perineum—a cut into the urethra upon the stone. This was recommended for boys; in men the bulb is in the way, and it tends in the course of years to bulge farther backwards under the anterior fibres of the external sphincter. A safe lithotomy for a child with a small stone was done by dispensing with the semilunar incision and making a small mediary incision into the membranous urethra. In the early part of the 19th century the operation, under the name of the 'boutonnière', was one of the best known.

In the 16th century Marianus, in his 'Liber Aureus', described the operation of the 'apparatus major', the insertion of the grooved median staff with the drawing upwards of the penis and bulb—the short median incision upon the groove into the membranous urethra—then the passage along the groove into the bladder in succession of the probe or exploratorum—of the ductores or guides and of the dilator—*dilatans sive aperiens.* The grave objection to the method was the pain caused, as is shown by the illustrated statement that six men were needed to hold the patient. Now under anaesthesia, whether the superficial semilunar incision is used, or merely the short median one, a Teal's probe-pointed gorget can be passed along the groove of the staff, and if then a second gorget is pushed along the first, after withdrawing the staff, and reversed, the prostatic urethra may be gently dilated as far as is necessary. As to the lateral lithotomy incision, which has also been adapted of late for prostatectomy, there was all the difference between the stab through the ischiorectal fossa and the lateral lobe of the prostate into the trigone, and the modified safer operation by using a median staff, whether curved or straight (Key's). After making a superficial lateral incision into the ischiorectal fossa, the knife might be entered into the groove behind the bulb, and the edge of the knife being directed backwards, as it was pushed along the floor of the urethra, then only the membranous and just the floor of the prostatic urethra was cut.

With the introduction of prostatectomy came the necessity for directing attention to certain anatomical points.

Wallace and Shattock examined specimens of prostatic enlargement preserved in museums, also prostatic tumours removed by the suprapubic method, as well as what remained of the prostate in patients dying after the operation. They extended and confirmed the observations originally made by Morgagni, adding that of microscopic examinations. They demonstrated that the prostatic enlargement consists of glandular encapsuled tumours, surrounded by a compressed lamina of gland substance beneath the capsule proper of the gland.

It is of primary importance that the finger in commencing to shell out the tumours should be so used as not to rupture this compressed lamina of the gland and the capsule outside it. On the other hand, it is necessary that all the adenomatous tumours should be shelled out to prevent recurrence of retention. The circular fibres of the bladder form a regular layer around the trigone, and close above the prostate form a dense circle. Henle, from examining the dead subject, stated that it was a sphincter which did not perform the function of a sphincter. But experiments by Rehfisch and others have proved that the circular fibres are the true internal sphincter of the bladder. Continuous with this internal sphincter is the intrinsic muscle of the urethra: its inner longitudinal fibres immediately under the mucous membrane of the prostatic and membranous urethra are continuous with the internal submucous longitudinal fibres of the trigone, and the outer circular fibres are continuous with the internal sphincter. This bladder and urethral unstriped muscle is supplied by sympathetic nerves, which are connected with the spinal cord through the prostatic and hypogastric plexuses, the inferior mesenteric ganglia, and the ganglia of the sympathetic chain. The compressor urethrae is a voluntary striped muscle innervated by the branches of the internal pudic nerve. When in tabes dorsalis the disease of the posterior columns of the spinal cord impairs or completely paralyses the sympathetic nerves innervating unstriped muscle, the internal sphincter is paralysed, and if this becomes complete and includes the intrinsic muscle of the urethra there is incontinence, in spite of the compressor urethrae remaining fully innervated. The appearance of the interior of the bladder, as viewed with the cystoscope, is then that of a dilated atrophic trabeculated bladder with a small flat trigone, and the ureteral orifices do not show contraction. When the prostate enlarges, the internal sphincter becomes spread out over it, and in the course of suprapubic prostatectomy may be permanently weakened.

Wallace and Page published an X-ray photograph taken after prostatectomy by filling the bladder with a bismuth emulsion, showing the position of the prostatic urethra occupied by a funnel-shaped dilatation, owing to the internal sphincter having become stretched. This is not necessarily the case, for a specimen of a bladder some time after suprapubic prostatectomy recently presented to the museum of the Royal College of Surgeons by Sir Rickman Godlee shows a perfect restoration of the internal sphincter. Watson has claimed that in 25 cases after perineal prostatectomy following Young, the internal sphincter was found normal, as shown by collargol cystograms.

**The examination of the urine.** The alteration in the urine of first importance in forming a prognosis is the lowering of the specific gravity and the increase of quantity. When the specific gravity has fallen below 1,010 and the quantity has risen to be double, then it may be suspected that the excreting substance of the kidneys has been gravely reduced. Bradford, in his experiments, found that the above reduction of specific gravity and increase of quantity could be produced in dogs by removing some two-thirds of the total renal substance of the two kidneys. In such cases it is necessary to estimate the amount of urea excreted from day to day.

Indirect tests of the excretory functions of the kidneys have been generally adopted. Conclusions should not be based upon any one indirect test, and all should be looked upon as aids and not as substitutes for the direct tests. Rowntree and Geraghty, in an important experimental and clinical study of the tests employed to estimate the functional activity of the kidneys, concluded that in addition to the routine chemical and microscopical methods of examination of the urine, together with the clinical examination of the patient, there were other tests of functional activity which should be employed. As of particular value in cases of enlarged prostate, they recommended the colour test by phenolsulphonephthalein which, since then, has been the test most largely used.

Twenty minutes or half an hour beforehand the patient is given a glass of water to favour diuresis. A catheter is first passed to empty completely the bladder. 1 c.cm. of the carefully prepared solution of monosodic salt of phenolsulphonephthalein, containing 6 mg. of the colouring matter, is injected subcutaneously into the upper arm. The urine is then allowed to drain through the catheter into a test-tube, in which is a drop of 25 per cent. sodium hydrate, and the time of the first appearance of the faint pinkish tinge is noted. Then the catheter is withdrawn or plugged, and at the end of the first and second hours the bladder is emptied and the colour of the urine compared with standard colour tests. The colouring matter should appear in the urine within 5–10 minutes of the injection; a delay of 20 minutes or more indicates a grave defect; most of the dose should have been excreted at the end of two hours; if less than half has appeared the unfavourable prognosis is confirmed.

**Preliminary drainage.** The practical importance of the examination of the urine is that it determines the question whether the bladder should first be drained, whether the treatment should be divided into two stages, drainage first, then removal of the tumour. A preliminary course of urinary antiseptics, with particular care to empty the bladder frequently and completely, may arrest cystitis and cause the urine to become acid; if the patient is tolerant, careful catheterism and irrigation of the bladder causes pus to disappear; then it may be found that the kidneys are excreting fairly normal urine.

The operation in two stages has obvious drawbacks, which are emphasized by Freyer in his latest communication; it delays the radical measure and renders it more difficult to enucleate the tumour, owing to the induration of the suprapubic wound. He had adopted preliminary suprapubic drainage of the bladder in 73 out of 1,550 cases, i.e. in 4·75 per cent.

Against this must be set a number of American communications, showing an increasing tendency to employ drainage, all the more so that the effect of the drainage has an important influence on prognosis. In the case of a patient who is passing urine of a low specific gravity, 1,010 or lower, and an increased quantity, whether or no the urine contains albumen or sugar or both, then, after instituting drainage of the bladder, the condition of the urine may improve. If it does not so improve, then the risk of prostatectomy is great and it may be wiser to advise a persistence in the drainage, as giving the better chance of prolonging life. If, after instituting drainage, the urine increases in specific gravity, diminishes in quantity, and the albuminuria and glycosuria are reduced or disappear, then it is held that the risks of prostatectomy have been much diminished; deaths from low types of uraemia, cardiac failure, and broncho-pneumonia are less in number.

Under a short general or local anaesthesia the bladder can be punctured with a large trocar and cannula, a self-retaining rubber catheter passed through the cannula and the cannula withdrawn. The patient need not remain in bed after a day or so, and may go about with the end of the catheter in a urinal. Gardner did prostatectomy after drainage in 112 cases of feeble patients without a death; the 113th case died of pulmonary embolism on the fourteenth day.

**Anaesthesia.** Chloroform continues the best drug for use by those not specially instructed, always provided that the patient is never put under the stage of what is called surgical anaesthesia except just when the surgeon is actually shelling out the tumour. After that the patient's head should be lowered and warmed air or oxygen may be blown into the throat; if there is a marked fall in the pulse tension, a little ether may be given whilst the surgeon is finishing. Mixtures of ether with chloroform are objectionable in the early stages of the operation. The amount of chloroform used should be proportioned according to the effect on the patient and should always be the least possible amount.

The harm done by ether varies according to its amount, and large quantities must be used to produce relaxation of the abdominal wall by the 'open' method.

Gas and oxygen, and spinal anaesthesia are the methods employed by those skilled in their administration. But even when administered by such, neither alone has proved quite satisfactory. Gas and oxygen may fail to produce sufficient relaxation of the abdominal wall; spinal anaesthesia may cause a sudden fall in pulse tension, especially when that has been previously above normal. A combination of the two procedures is recommended by Page:

The patient is first given an intraspinal injection of about half a dose of novocain or stovain, sufficient to ensure muscular relaxation, without causing a great fall in blood-pressure. Then sufficient gas with oxygen is given to produce unconsciousness of pain, from which the patient will recover as soon as the administration of gas and oxygen is stopped. Mortimer preferred chloroform followed by C.E. to the gas and oxygen. Local and regional anaesthesia is much employed by those who have not had the advantage of the assistance of skilled anaesthetists. The superiority over spinal anaesthesia is that there is not so much danger of collapse from fall of blood-pressure. For puncturing and incising the bladder above the pubes injections of novocain with suprarenin may suffice, but it takes much longer and troubles the patient more than a short spell of gas and oxygen. An injection into the perineum and membranous urethra may suffice for perineal drainage. To produce anaesthesia of the neck of the bladder, anaesthesia by the parasacral method following Braun was used by Casper in 15 cases. The needle was inserted at the level of the sacro-coccygeal junction, 2 cm. from the middle line. After coming into contact with the sacrum the point of the needle was directed close in front of the sacrum and parallel with the middle line and pushed upwards for 6 or 7 cm. from the skin, when it was calculated that the point of the needle was in front of the second sacral foramen. There, 10 c.cm. of a 1 per cent. novocain and suprarenin solution was injected. The needle was then withdrawn a little and 5 cm. more injected. Next the needle was directed a little more forwards and pushed upwards until the point was 10–12 cm. from the skin, when it was assumed to be over the first sacral foramen.

There, again, 10 c.cm. was injected and as the needle was gradually withdrawn an additional 5 c.cm. Finally, when the point was withdrawn until in front of the fourth sacral foramen 10 c.cm. was injected and finally 5 c.cm. as the needle was drawn out. This process was then repeated on the opposite side. In addition, a little 0·5 per cent. novocain suprarenin solution was injected under the suprapubic skin, into the recti and between the muscles and the bladder. Anaesthesia was established in 15–20 minutes, the interval being employed in washing out the bladder and other disinfections. It is well known that it is the adrenalin which is the essential agent and that the use of over 10 minims or drops, at any rate 24 minims, in the suprapubic region is very liable to induce sloughing.

**Haemorrhage.** The adoption of the suprapubic route for the removal of the smaller and harder prostates of younger men brings about an increased danger from haemorrhage, primary, recurrent, and secondary. Simple measures, irrigation with hot water or pressure by a swab on a holder for a few minutes, and, if haemorrhage recurs, applications of adrenalin, appear to have proved insufficient in the hands of American surgeons.

The position of the blood-vessels must be held constantly in mind, so that the finger of the surgeon applies force in a direction away from their position. So far as severe venous haemorrhage is concerned, this is endangered by penetrating through the remaining lamina of gland substance into the prostatic capsule, especially between the prostate and the rectum. As to the arterial haemorrhage, which may cause recurrent or secondary haemorrhage in men between 50 and 60, the anatomical description of the course and distribution of the inferior vesical artery must be recognized. It is a large branch of the internal iliac artery which, after crossing in front of the ureter and over the bend in the vas deferens, is distributed to the trigone of the bladder, vesicula seminalis, and to the prostate. The branches to the latter enter from the outer and upper angle, whilst the arteries to the internal sphincter lie over the upper surface of the prostate. The method by which these branches are the more likely to escape injury is by commencing to shell out the adenomas by inserting the finger into the prostatic urethra, scratching through the upper aspect of the prostatic urethra to find the loose tissue bounding the encapsuled tumour. The tumour may then be separated without damaging the wall of the bladder and internal sphincter forming the upper boundary. If, however, commencement be made from the pouch behind the so-called middle lobe, the outspread internal sphincter and the floor of the trigone are partly torn and inferior vesical artery branches actually torn across.

Schmidt and others in America appear to have adopted, almost as a routine, special measures against haemorrhage. For arterial haemorrhage, the suprapubic wound may be held apart, the interior of the bladder illuminated, and bleeding-points in the lateral wall of the excavation seized and ligatured. To prevent venous haemorrhage the rubber bag used in the uterus and the nose, has been adapted. That called Hagner's bag has its stem passing out by the urethra; that called Pilcher's has a second stem brought out through the suprapubic wound for greater convenience in filling and emptying. Water is used to distend the bag. The bag is deemed a less onerous apparatus than the gauze plug.

The gauze plug may be used to fill the excavation firmly and the end brought out through the suprapubic wound, a large tube being inserted alongside. A more painful use of the plug is that of tying a ligature round the centre of the fold, and threading the end of the ligature through the eye of a urethral catheter. Then, the catheter being withdrawn, traction is made through the urethra so as to hold the fold of gauze firmly down against the triangular ligament. In face of recurrent or secondary haemorrhage a metal prostatic catheter, with a long and wide curve, is passed and the end made to protrude through the suprapubic wound. Then a fold of gauze may be drawn down tight. If need be, instead of the end passing out through the urethra, a buttonhole may be made in the perineum and the end of the ligature holding down the gauze brought out and tied over a roll of gauze on the perineum.

A necessity for the administration of morphia owing to the pain is a serious objection to all the foregoing forcible methods of controlling haemorrhage. The advocates of perineal prostatectomy hold that the frequency of dangerous haemorrhage is the result of adopting the suprapubic route for unsuitable cases.

**The union of the suprapubic wound.** In accordance with Freyer's recommendation a large tube is inserted around which the wound is closed. The advantages gained are free drainage and facility for washing out blood-clot which would otherwise decompose. The immediate objection is the necessity for the constant attendance of a well-trained nurse in order to keep the patient dry and the large quantity of wool used. To minimize the latter Irving's apparatus is applied to conduct the urine into bottles, or a smaller tube, such as a catheter, is inserted, by which the urine can be syphoned off. The later trouble is that a fistula persists, involving further operative measures, such as scraping, paring, and suturing.

Hence in uncomplicated cases the suprapubic wound has been sutured, much as described by Ralph Thompson. In 13 cases the bladder wall was sewn up by a double row of catgut sutures, the deeper row through the muscular wall but avoiding the mucous membrane, the superficial row invaginating the deeper row. Next a strip of gauze was inserted into the cavum Retzii and brought out at the lower angle, the rest of the abdominal wall being united by interrupted sutures. Sutures were inserted so as to take up the recti and pyramidales, alternating with sutures including only the superficial fascia with the skin. One of the latter was inserted below the strip of gauze. A coudé catheter passed well into the bladder was tied in, and through this, the bladder was frequently washed out with hot sodium citrate solution to prevent the formation of clot. The plug was removed from the suprapubic wound on the second day, the catheter left out on the tenth day, and the patients got up about the fourteenth day after the removal of the sutures.

Amongst modifications of the above it may be noted that some think there is less danger of a recurrence of haemorrhage if the bladder is left alone, and that irrigation may induce bleeding. If the patient is intolerant of catheterism, the catheter may be passed out through the perineum.

**Perineal prostatectomy.** The small hard prostrate may not be easy to detect; there may be nothing noticeable through the cystoscope; in the event of the bladder being thickened the examination per rectum may give rise to the idea that the prostate is much larger than it is in reality. Gardner used the catchwords 'the silent prostate' to denote the cause producing:

(1) An irritable bladder, the irritability increasing first by night and then by day, gradually leading to retention;

(2) Painful retention, relieved by doses of morphine and hot baths; later, catheterism becomes necessary and epididymitis may follow. 10 per cent. of those starting catheter life die within two months;

(3) Colon bacilluria, whether started by the retention or by the catheterism, induces pyelonephritis; either the infection ascends the ureters, or perhaps reaches the kidneys through the blood-stream;

(4) Painless incontinence, i.e. retention with overflow, causes insidious changes not only in the bladder and kidneys, but also in the heart. It is a cause of cardiac failure which may be readily overlooked.

The warning signs of the condition in the urine are the fall in the specific gravity and the increase in quantity.

Ritter collected instances of so-called prostatic atrophy attended by retention. One form, made up of mucous membrane, muscle-fibres, and gland-substance, caused a valvular obstruction. Prostatitis probably following gonorrhoea had reduced the two lobes of the prostate to the size of beans. The prostate, no longer divided into lobes, formed a constricting ring which projected into the bladder, something like a small cervix uteri. In such a condition even a very small projection in the position of the so-called middle lobe much increases the obstruction.

Prostatic calculi, which must not be confused with calculi impacted in the prostatic urethra or situated in the retro-prostatic pouch, occasionally form in the gland as a sequela to urethral stricture. The calculi form in the middle of the gland, probably in connexion with the corpora amylacea of Morgagni, and are differentiated from bladder calculi by containing a little carbonate. They may be recognized before removal in an X-ray photograph.

The intra-urethral operation for such cases, Bottini's and its modifications, Young's prostate punch, and the revival by Luys of tunnelling the prostate by a cautery, have all proved unsatisfactory on extended trial. A raw surface is produced through which there is septic absorption, for there is no drainage of the bladder to conduct it off.

The essential part of perineal prostatectomy is similar to the suprapubic method. The shelling out commences from the prostatic urethra by working from below; there need not be much damage to the internal sphincter, nor need there be much danger from venous and arterial haemorrhage. If the shelling out cannot be done without exercising undue force, then the obstruction can be cut or punched away piecemeal. This is entirely superior to the intra-urethral method, for it can be done under view by drawing down the prostate with Young's tractor and under the guidance of the finger. If this sets up any haemorrhage the vessel can be much more easily ligatured. It is generally stated that the chief objection to the perineal operation is the persistence of a perineal fistula. This is only liable to follow the more extensive operations for cancer; in benign cases, so long as the incision into the membranous urethra is strictly a median one, healing quickly occurs.

The semilunar incision of Celsus revised by Dittel and Zuckerkandl should penetrate the ischiorectal fossae behind the nerves from the internal pudic to the compressor urethrae. The centre of the incision is superficial where it crosses the middle point of the perineum. The tendinous septum should be seized with thumb and finger and snipped through with blunt-topped scissors. The exact point cut through should be the posterior fibres of the ejaculator urinae; this will expose the bulb, which can then be pushed and retracted forwards, whilst the finger and thumb push the transverse perineal muscles and the external sphincter of the anus backwards.

It is then easy to make a median incision into the membranous urethra upon the groove of the staff. Not only need no fistula persist, but even if the operation is repeated healing will occur. As an instance, Case 4 described by Spencer in 1901 may be recalled. At that date the man had already undergone five operations for stone, lithotrity, suprapubic lithotomy, and lateral lithotomy, then twice median perineal lithotomy with the superficial semilunar incision. Subsequently this last operation was repeated five times more for the removal of calculi in the sacculated prostate. The man kept an account of each operation; the last one healed in a month. He then died slowly of uraemia. The kidneys, ureters, and bladder exhibited the usual changes: the kidneys dilated to mere sacs, the ureters dilated and thickened, the bladder thickened and fasciculated. But there was an internal sphincter above the sacculated prostate and the membranous urethra showed a thick but linear scar soundly healed. The bulbous portion of the urethra had been kept dilated.

Healing also occurred after the shelling out of a large sarcoma. A boy of 19 was admitted with acute retention and partial intestinal obstruction caused by a large sarcoma of the prostate. The first signs had been noted three months before. The large mass between the bladder and rectum, consisting of a soft small round-celled sarcoma, was scooped out from within a sort of capsule, and the perineal wound had healed in three months, although by then he had developed phlebitis and oedema of the thighs, scrotum, and penis. He continued to pass urine naturally through the penis and the perineum remained sound whilst he wasted until his death, seven months after the operation, from extension of the disease to the abdomen. There was no return either of the urinary or intestinal obstruction.

Praetorius found the median 'boutonnière' incision sufficient, and, especially when the operation is done in two stages, it ensures the least possible disturbance. The one objection is the distance from the perineum to the neck of the bladder and the impossibility of making counter-pressure, as is done in the suprapubic operation from the rectum. In order to avoid injury to the 'external sphincter' after cutting into the membranous urethra, Praetorius passed in a fine two-bladder dilator, after the pattern of the Otis instrument, and he made no cut into the prostate. The separation of the tumour from its capsule was begun from the prostatic urethra. For scratching through, he put on a thimble to spare his nail. He injected novocain before making the 'boutonnière' because that shortened the period of general anaesthesia; general anaesthesia was desirable because then aid could be obtained by making counter-pressure on the hypogastrium, which could not be obtained with either local or sacral anaesthesia. After the operation a catheter 30 Charrière was inserted and fixed by a suture to the skin of the perineum, which was retained for 8–10 days. There was no need to plug around the catheter.

In weakly patients partial removal of obstructing portions can be done, using a small kind of lithotomy forceps. In the worst cases, the catheter is simply inserted through the boutonnière opening, and the effect on the urinary excretion observed.

In order to overcome the objection that the skin of the perineum is so far from the neck of the bladder, and as an alternative to the horse-shoe incision, a modified left lateral incision has been used by Ochsener in Chicago and by Wilms in Heidelberg.

Wilms reported in 1917 that he had practised perineal prostatectomy through a left lateral incision for the previous eight years on more than 200 cases, 50 having been done within the previous year. He brought out the drain at the posterior angle of the superficial incision and put in sutures in front. The operation might be done in two stages.

Wilms had no trouble in arresting haemorrhage; free oozing immediately following removal was arrested by pressure from the rectum, using the blade of a broad retractor.

Oehsener also had adopted perineal prostatectomy through a left lateral incision. After removal he seized the margin of the capsule with forceps and passed in two tubes, one into the bladder and the other into the excavation only, and then packed around with gauze which was removed in two days. The operation could be done in 15 minutes. As a matter of experience there should hardly ever be any need for special measures against haemorrhage after perineal prostatectomy.

Wildbolz advocated perineal prostatectomy because in 150 cases his mortality had been 5 per cent., whereas in 40 cases of suprapubic prostatectomy it had been 25 per cent.

**Cancer of the prostate.** A special operation for the removal of all the prostate along with its capsule cannot be clearly indicated. If the malignant disease is still confined to the original tumour, it can be shelled out. As already mentioned, Freyer has described successful cases. Others have done so with like success from the perineum. If, on the other hand, the malignant disease has spread beyond the capsule, the removal of the prostate and its capsule is useless and tends to shorten life. Drainage will give more relief, unless, as in the case of sarcoma noted above, the soft centre is removed to overcome obstruction. Two methods of removal of all the prostate and its capsule both spare the compressor urethrae and its nerve-supply, so that the patient regains control of micturition.

Young has continued to make improvements in his well-known method, and now, according to his latest description, it has the great merit of avoiding injury not only to the compressor urethra and its nerves, but also to the sympathetic fibres distributed with the upper branches of the inferior vesical artery to the region of the trigone about the ends of the ureters. The semilunar incision is made, the central tendon of the perineum divided, the bulb and membranous urethra pushed forwards, and the anus and transverse perineal muscles backwards. Keeping chiefly to the middle line and pushing aside the levator ani, blunt dissection is pursued behind the prostate and the vesiculae seminales. Young then turns to the front aspect. But Proust here inserts a notable modification before proceeding to Young's next step. On reaching the back of the vesiculae, in the convergence of the vasa deferentia, Proust incises the capsule of each vesicula to the inner side, and then passes a blunt hook under the vas. With the hook the vas is pulled down in its course from without inwards in front of the ureter. Having distinguished the white smaller and harder vas from the large, softer, and more vascular end of the urethra, the bladder end of the vas is clamped and cut across above the clamp. Proust thus defines the line of removal from behind, running transversely below the termination of the ureter and above the end of the vas. At the same time the lower branches of the inferior vesical artery can be ligatured, whilst the upper branches distributed to the ends of the ureters, together with the sympathetic nerves, are uninjured. Returning to Young's method, he divides the urethra at the apex of the prostate, inserts his tractor and draws down the prostate. Then, by blunt dissection in the middle line in front the anterior aspect of the bladder immediately above the prostate is exposed; next it is cut through by an anterior transverse incision which is continued outwards until the trigone and orifices of the ureters can be seen. The posterior incision runs straight across the trigone, 1 cm. below the ureteral orifices. There remains after this the division of the vas and the ligature of the arteries, which Proust interposes at an earlier stage. Then comes the more difficult part of the operation, the suturing together of the cut edge of the bladder, so as to reduce it until it can be united to the membranous urethra over a catheter. When this has been completed the perineal wound is plugged. Young claims for this latest modification that control of micturition is regained in the majority of cases, and that there is a radical cure in 60 per cent.

Russell Howard described the successful removal of the prostate and its capsule through a suprapubic incision. The specimen removed proved to be a tubular and solid cubical and polygonal-celled carcinoma of the prostate. As to the precise indications for such an operation, it would be necessary to demonstrate that the disease had already invaded the capsule, and in a later report to show that the disease had not extended beyond the capsule before the operation.

Howard first made the horseshoe-shaped incision in the perineum and separated the rectum as far up as the vesiculae. Then, turning the patient into the Trendelenburg position, and exposing the front wall of the bladder above the pubes, the peritoneum was pushed back until through the cavum Retzii the posterior layer of the triangular ligament was reached. Then the junction between the prostatic and membranous urethra was divided transversely, and the prostate and fundus of the bladder drawn up into the suprapubic wound. The ureters and their terminations having been identified, the base of the bladder below was cut across, and the prostate with the vesiculae seminales removed. In the course of the operation all bleeding points were within view, so that they were immediately clamped and afterwards tied. This being done, the bladder was simply dropped back. A catheter with lateral holes was passed through the penis into the bladder and out by the suprapubic wound. Also, a drainage tube was inserted into the perineal wound. Both the suprapubic and perineal wounds were finally sutured around the drainage tubes. The suprapubic protrusion of the catheter was withdrawn into the bladder on the 5th day; the perineal tube was omitted on the 8th day; the catheter into the bladder was changed on the 18th day; it was omitted on the 28th day, when the patient got up with the wounds healed. On the 32nd day a No. 12 bougie was passed, when the patient had his first and only rigor. He left the hospital on the 36th day, when he could hold his water for six hours. Seen subsequently, there was no incontinence, and a full-sized bougie could be passed. What is remarkable and new in this case is the healing and rapid regaining of control, although no attempt was made to suture the lower cut edge of the bladder to the membranous urethra.

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**Young, H. H.** (1). Conservative perineal prostatectomy, a presentation of new instruments and technic. *J. Am. M. Ass.*, 1903, **41**, 999.

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W. G. S.

# ABSTRACTS

## NEUROLOGY

**Friedländer, R.** Die hemiplegischen Bewegungsstörungen und ihre Behandlung. [**The treatment of post-hemiplegic disorders of movement.**] *Therap. d. Gegenw.*, 1919, April u. Juni. (*Neurol. Centralbl.*, 1919, **17**, 566.)

In a recent paper, R. Friedländer discusses the treatment of post-hemiplegic disorders of movement, more particularly the spasticity and loss of power seen in residual hemiplegia. He lays great stress on the primary importance of active exercises as opposed to such passive procedures as massage and electrical therapy. Treatment should begin at once to avert, as far as possible, the formation of contractures. For this purpose, during the initial flaccid stage, he recommends slow and gentle passive movements of the limbs, and the careful placing of these in correct postures, which must be constantly varied. Massage and other forms of treatment may, at this stage, be omitted.

When spasticity is developing, certain new difficulties arise from the appearance of reflex movements of the legs, when these are manipulated, which lead to the formation of vicious attitudes. Faradism is absolutely contra-indicated at this stage, and the only form of electrical procedure allowable is mild galvanism insufficient to produce visible contraction of the muscles. When the stage of residual hemiplegia is reached, the rôle of active movements becomes of the first importance. These should be the common co-ordinated movements performed in everyday life. They may with advantage be performed bilaterally where possible, for the movements of the normal limb facilitate those of the affected one. Active exercises during immersion in a bath are also recommended. Faradism is still to be employed with caution, as likely to aggravate the spasticity.

In the consideration of this important question we must take into account certain physiological principles governing the incidence of paralysis and spasticity after lesions of the pyramidal tract. It has long been known that these have, in a measure, a selective incidence in certain muscle groups in the affected limbs (Wernicke and Mann). It also appears from Sherrington's physiological researches that normal muscle tone has a selective distribution in the skeletal musculature, and that it is a highly co-ordinated reflex phenomenon, the function of which is the maintenance of posture. Recent clinical observations indicate that the spasticity of pyramidal tract disease is a true hypertonus in those muscles which normally exhibit postural tone. We find, in the arm in hemiplegia, that the flexor group becomes spastic, while in the antagonist extensor group no hypertonus can be demonstrated. In the lower limbs, the extensor and plantar-flexor groups become spastic, and this extensor type of rigidity is constant in uncomplicated lesions of the pyramidal tract. The flexor and dorsiflexor group present no increase of tone and offer no resistance to stretching (by passive extension of the flexed limb) comparable to the resistance met when we attempt to flex or dorsiflex the extended limb.

Further, the spastic muscles are found to retain more residual power than their relatively atonic antagonists. Flexion and dorsiflexion of the spastic paretic lower limb in hemiplegia are notably weaker than active extension and plantar-flexion. To this we owe the characteristic features of the hemiplegic gait, namely, circumduction and dragging of the toe.

It seems reasonable to consider these facts when the treatment of spastic paralysis is in question, for, since these muscles are differently affected, it may be necessary to accord them differential treatment. While it may be correct to say that faradism aggravates spasticity, it is not necessary to conclude that it has no place in the treatment of spastic paralysis. What is bad for the spastic muscle may be of great value to its weaker and relatively atonic antagonist. Thus, in hemiplegia, one might suggest the application of faradism and massage to the extensors of the arm and to the flexors and dorsiflexors of the lower limb, while for the antagonist spastic groups passive stretching movements alone would be indicated. In hemiplegia, though not in paraplegia, no inconvenience arises from the production of involuntary reflex movements, since when they occur they are seldom of great violence and are limited to the lower limb, where they are flexor in type.

There are no recorded observations by which the value of these suggestions may be tested, though the writer carried out certain limited observations on the point in cases of disseminated sclerosis with spastic paresis of the legs, and in some hemiplegics. It is notoriously difficult to judge of the value or effects of treatment in such cases; rest and general treatment, and other more obscure causes, give rise to such variations that dogmatic conclusions on the subject are rarely justified.

Nevertheless, it appeared that the general extensor rigidity of the leg was not increased by these measures, while the power of lifting the limb in walking seemed materially improved, and there seemed justification for further attempts at a more rational mode of treatment than at present obtains in this respect. F. M. R. W.

**Lhermitte, J.** Sur l'intoxication par la strychnine chez l'homme. Strychnine, tétanos, tétanie. [**The symptomatology of strychnine poisoning.**] *Rev. Neurol.*, 1919, **7**, 598.

Opportunities of studying the effects of strychnine in poisonous doses upon the nervous system of man occur but rarely, and in view of recent advances in our knowledge of the reflex functions of the human spinal cord, such an investigation should afford information of great interest. Lhermitte was able to make such an observation in the following circumstances:

Four young soldiers, convalescent from influenza, but otherwise healthy, were each inadvertently given a single excessive hypodermic dose of strychnine sulphate. In two instances the dose was 2 cg., and in two 4 cg. were injected.

In a very few moments they all experienced numbness and formications in the legs, and then over the whole body, with a sense of heaviness of the limbs accompanied by pain. A few minutes later the limbs entered into a tonic extensor rigidity, and there was orthotonus and trismus. The patients lay extended upon their beds utterly helpless, unable to articulate or to swallow. The heart's action is described as having been forcible and rapid.

In three, this tonic condition persisted for half an hour; in one of those who had received the larger dose it persisted for 1½ hours, during which time respiration was difficult and the patient's face expressed considerable distress. Complete relaxation was found in all four after about six hours. Next day all were able to stand, but walking caused rigidity of the legs, so marked in one man as to prevent his walking at all. A day later they were subjectively well and free from disability.

From this date onward during the two weeks they remained under observation certain objective phenomena were constantly found. The tendon jerks were markedly increased, and there was bilateral ankle clonus. The cutaneous reflexes, on the other hand, were definitely diminished, and in one case the abdominal reflexes were not obtainable, while in another the plantar response was of the extensor type. In all, 'superficial excitation of the limb' caused a rapid forcible movement of flexion, followed by one of extension, and Lhermitte regards this as a genuine flexion reflex (the 'réflexe de défense' of French authors).

The direct excitability of the muscles was also greatly increased, though percussion did not provoke a tonic spasm of the muscles.

To both forms of electric current there was an increased excitability of both nerve and muscle, but no qualitative change.

These phenomena were still present 15 days later, when the men were discharged from hospital.

Lhermitte points out that these residual signs are identical with those found in chronic forms of tetanus, and that in tetany also a very similar symptom-complex may be found. From this he concludes that the effect upon the nervous system in each case is the same. He suggests the following explanation of the action of poisons with the strychnine-effect upon the nervous system, namely, that these act not only upon the primary afferent neurone, but also on the ventral horn cells which are excited, while the influence of higher centres upon the cord is inhibited. Thus the cord is liberated from cerebral control, and the signs of strychnine poisoning are therefore manifestations of independent spinal reflex activity.

Such a view is scarcely in accord with that enunciated as a result of physiological experiments by Sherrington, who found that the action of the drug was to convert the process of inhibition in the spinal and bulbar centres into excitation. This involves the disappearance of reciprocal innervation, and therefore the abolition of co-ordination of movement. Under strychnine, appropriate stimulation no longer elicits a co-ordinated reflex act with contraction of the prime movers and simultaneous inhibition of their antagonist muscles. But instead, there is generalized contraction of both groups simultaneously. This process of conversion probably takes place not in the cortex, but in the bulbo-spinal centres upon which this acts.

This is a totally different process from that of uncontrolled reflex activity of the liberated cord, a condition which is seen fully developed in the late stages of spinal cord transection in man, and, in certain respects, in the spastic paralysis of hemiplegia.

Experimentally, this process of conversion of inhibition under strychnine may be seen with doses insufficient to produce tonic spasm, and therefore the observations are perhaps comparable with those of Lhermitte made after the tonic phase had subsided. It is somewhat unexpected, therefore, to find that 'les réflexes dits de défense' were obtained in his cases. The most common of these is the flexion reflex, which we know is a true purposive reflex act, exhibiting reciprocal innervation. From Lhermitte's description it is not quite clear whether the rapid, clumsy flexion-extension movement he obtained, and which he says showed no trace of adaptation, really was a true co-ordinated reflex movement, or merely an inco-ordinate spasm. Therefore, while this paper provides many valuable clinical details, it throws very little light upon this interesting physiological problem, and the analogy between strychnine poisoning and 'spinal automatism' is of uncertain value.

F. M. R. W.

**Eberstadt, F.** Klinische Untersuchungen über Lähmung des Musculus iliopsoas. [**A clinical test for paralysis of the iliopsoas.**] *München. med. Wchnschr.*, 1919, **36**, 1026.

The determination of an isolated paralysis of this muscle presents peculiar difficulty. It is neither palpable nor capable of electrical examination, while the action of the muscles normally synergic with it—sartorius, pectineus, rectus femoris, and tensor fasciae latae—largely conceals any inaction of this muscle.

Its principal function is the flexion of the thigh upon the pelvis; its action in flexing the pelvis when the thigh is fixed is less important. Its paralysis is most obvious to the patient in his difficulty in going upstairs or in placing his foot upon a chair.

In testing for paralysis of this muscle, the patient must sit bolt upright, with the legs extended horizontally before him on the bed or on a couch. In this position the insertions of the synergically acting muscles named above are approximated and their action thus excluded. The patient is then asked to raise the extended limb from the bed, and is found to be unable to do this. This observation was first made by Ludloff in a case of fracture and separation of the small trochanter of the femur into which the muscle is inserted.

Paralysis of the iliopsoas may be found in injury with separation of the lumbar transverse processes from which it arises, similar injury of the small trochanter, in psoas abscess, in poliomyelitis, and in anterior crural nerve lesions. In the last-named instance paralysis of other muscles with the same nerve-supply is associated with it.

The paper contains the clinical record of several cases. F. M. R. W.

**Vogt, C.** und **O.** Erster Versuch einer pathologisch-anatomischen Einteilung striärer Motilitätsstörungen nebst Bemerkungen über seine allgemeine wissenschaftliche Bedeutung. [**A classification of motor disorders from lesions of the corpus striatum, upon a pathological-anatomical basis.**] *Jour. f. Psychol. u. Neurol.*, 1919, **24**. (*Ztschr. f. d. ges. Neurol. u. Psychiat.* (Ref.), 1919, **18**, 394.)

From an extended pathological study, the authors differentiate four separate disease processes in the corpus striatum, each underlying a distinct and separate symptom-complex. These are:

1. *The 'état marbré'*, due to circumscribed areas of loss of nerve cells, and their replacement by a network of fine myelinated nerve fibres. The striatum is diminished in volume and has a marbled appearance. Clinically,

symptoms appear early in infancy, and the condition may be congenital. It tends to regress during life. It is characterized by rigidity of the limbs, with a variable degree of loss of power, which renders all movements slow and clumsy. Athetosis is constant, and the cases of so-called 'double athetosis' belong to this group.

2. *The 'état fibreux'*, a selective necrosis of ganglion cells and of fine nerve fibres. The result is an approximation of the large intact fibres, producing the appearance of abnormal richness of this type of fibre, with reduction in volume of the striatum. A slowly progressive chorea, without mental symptoms, like that seen in Huntington's chorea, is the clinical expression of this condition.

3. *Total necrosis of the striatum*, consisting in a total loss of all the nervous structures of the striatum, which is thus reduced to a porous spongy mass. Progressive lenticular degeneration (Wilson's disease) is the clinical aspect of this. It begins in early life and runs a slowly progressive course. It is often associated with changes in the liver.

4. *Acute lesions of the striatum*, due to either haemorrhage or softening. A sudden onset and gradual improvement is the clinical characteristic of this condition. If paralytic phenomena have also been produced by the lesion, the pure corpus striatum symptoms only make their appearance when these have cleared up. The symptomatology varies greatly: pure rigidity of Parkinsonian type, with or without tremor, chorea, or athetosis. In circumscribed lesions symptoms like those of pseudo-bulbar paralysis, spasmodic laughter and festinant gait appear. F. M. R. W.

**GOLDSCHMIDT, W.** Ergotismus und Tetanie. [**Ergotism and tetany.**] *Wien. klin. Wchnschr.*, 1919, **32**, 452.

In Turkestan, during 1915 and 1916, Goldschmidt observed a number of cases of ergotism among prisoners of war. In the spring of 1915 a few cases were seen at Tashkent, and a large number in the early summer of 1916 at Rasalinsk on the Steppes.

Most of the patients came complaining of painful formications affecting the hands and feet, cramp in the forearms and legs, with pain slight or severe, especially in the forenoon. In only a few cases were there vesicles on the toes. In two soldiers there was dry gangrene of the great toe. The severe cases chiefly presented convulsive symptoms of varying degrees up to severe tonic contractions and were weakened by obstinate diarrhoea. Only in a few cases could symptoms resembling tetany be noted. Fuchs had in 1915 conjectured that the ergot especially disturbed the parathyroids which caused him to describe it as an epidemic tetany. But Goldschmidt's observations did not strengthen the theory of Fuchs. The toxic symptoms produced by ergot do not fundamentally differ from those produced by other poisons, such as alcohol, in which there may be symptoms resembling tetany.

The bread supplied to the prisoners was characteristically coarse, black, very frequently with streaks of grey. It was made of rye flour ground in primitive mills. No microscopic examination could be made. The harvest was abundant in Russia in 1915 and 1916, and so it was possible to buy the finest white wheaten bread. Hence when the prisoners became patients and had this wheaten bread, these symptoms disappeared within a week or fortnight. Some slight cases improved, whilst continuing on the rye bread, apparently they became accustomed to it. W. G. S.

## PATHOLOGY AND BACTERIOLOGY

**Patterson, J. W., Little, E. M.,** and **Williams, S. E. Report on the bacteriology and pathology of forty-six fatal cases of influenza.** *Medical Research Committee, Special Report Series,* No. 36, 1919, 88.

The bacteriological findings were similar to those of others, *B. influenzae* being practically constant *post mortem.* Experiments were conducted to determine which animal was most suitable as a source of blood for growth of *B. influenzae.* Rabbit was found to be best, then horse, and lastly human. Human blood agar often failed to give a growth. All bloods when heated to 80° C. became equally efficacious and the growth was always more luxuriant. P. F.

**Tytler, W. H., Janes, R. M.,** and **Dobbin, G. M. Pathological and bacteriological findings in fatal cases of pneumonia during the influenza epidemic of October and November 1918.** *Medical Research Committee, Special Report Series,* No. 36, 1919, 77.

The authors made their cultures from *post-mortem* material for the most part on unaltered blood agar. *B. influenzae* was present in the lungs in practically every case (in 60 out of 67 cases). Haemolytic streptococci were very rare. *B. influenzae* was probably the cause of the bronchitis and the primary cause of the pneumonia, paving the way for the growth of other bacteria. P. F.

**Gibson, H. G.** and **Bowman, F. B. The bacteriological flora of the respiratory tract in cases of influenza.** *Medical Research Committee, Special Report Series,* No. 36, 1919, 37.

All primary cultures for isolation of bacteria were made on plain human blood agar. No special influenza medium was used for the isolation of *B. influenzae.*

In the examination of material from various parts of the respiratory tract obtained *post mortem,* the pneumococcus was not found. *Streptococcus viridans* was much more common than haemolytic streptococci. The incidence of *B. influenzae* was variable, being found frequently only in scrapings of the trachea. Blood cultures were made upon 20 patients and *B. influenzae* was not found.

Agglutination tests of formalinized cultures with patient's serum appear to have been sometimes unsatisfactory, since a greater agglutination occurred with the highest dilutions of serum. *S. viridans* was not agglutinated with patient's serum. P. F.

**Lister, F. S. The bacteriology of epidemic influenza on the Witwatersrand.** *Public. South African Inst. Med. Research,* 1919, No. **12**, 1.

The lungs of 56 fatal cases of influenzal pneumonia occurring among natives were examined and *B. influenzae* was recovered upon human blood agar from 53. 42 also contained pneumococci, while other specimens grew *M. catarrhalis,* staphylococcus, Friedländer's bacillus, *B. tuberculosis,* and streptococcus. *B. influenzae* was met with four times in pure culture.

Blood cultures were made from six cases of pneumonia, but in only one was a culture (of pneumococcus) obtained.

37 cultures of pneumococci from influenza patients were examined serologically to determine the 'group' classification, and it was noteworthy that only one belonged to the epidemic lobar pneumonia groups. The remainder were identified with normal respiratory tract strains and with *Pneumococcus mucosus*.

Young guinea-pigs were inoculated intraperitoneally with lung juice from ten cases. In two of these *B. influenzae* was found in the peritoneal exudate and in one from the blood, but always in association with some other bacterium. Five rabbits were inoculated intravenously with whole 'slopes' of *B. influenzae* without fatal results.

The author considers that his data supply strong evidence that *B. influenzae* was the cause of the epidemic. P. F.

**Lister, F. S.** and **Taylor, E.** **Experimental investigation of epidemic influenza at Durban.** *Public. South African Inst. Med. Research*, 1919, No. **12**, 9.

In this investigation the experiments were carried out upon eleven human beings (European) who came forward in answer to pecuniary offers advertised in the public press. None of the men admitted a previous attack of influenza, but all had, no doubt, been exposed to infection. At the time of the experiment the epidemic had declined. In order to reduce outside influences to a minimum, the men were transported 500 miles and housed upon an island off Durban, where no influenza had occurred.

The object of the work was to test the claims of a 'filter passing' virus to be the cause of influenza. The material used was nasal washings from typical influenza cases and sputum. The samples used were filtered and unfiltered, and immediately after preparation upon the mainland were transported to the island for use.

Nasal washings and sputum obtained upon the twelfth day of the disease were mixed and introduced into the mouth and nasal cavities of four men, filtered and unfiltered. They all remained well. *B. influenzae* was not obtained from the original material. Two monkeys were similarly treated without effect.

Exactly similar material was obtained from a second patient on the third day of the disease. Very little sputum was obtainable and *B. influenzae* was not found. On being introduced into four men, one developed typical influenza 36 hours after receiving unfiltered material. Monkeys were, however, unaffected.

Material was taken from a third case on the fourth day of the disease. Again *B. influenzae* was absent in cultures. Three volunteers were treated with this material applied in an atomizer to the anterior nares. One who received unfiltered material developed typical influenza without, however, *B. influenzae* being found, while two treated with filtered material remained well.

Experiments were then made with three stock strains of *B. influenzae* and two unidentified cocci. Living suspensions of these were introduced into the mouth and nose of nine men, but all remained well except one treated with *B. influenzae*; but the attack in this case could not be ascribed certainly to influenza.

A freshly isolated culture was then administered to seven men and four monkeys without effect.

Thus the only positive results were obtained from unfiltered material in the early stages of influenza. Filtered material and cultures were negative. Monkeys failed to be affected in any of the experiments. P. F.

**Larson, W. P., Cantwell, W. F., and Hartzell, T. B. The influence of the surface tension of the culture medium on the growth of bacteria.** *J. Infect. Dis.*, 1919, **25**, 41.

By adding pure castor-oil soap to liquid media the authors lowered the surface tension to various degrees and then studied the growth of bacteria under these conditions. Ordinary broth has a surface tension of about 59 dynes, water being 73, and it was found to be possible to lower broth to 32 dynes with soap solution. When *B. subtilis* was grown on broth below 45 dynes, instead of forming a pellicle on the surface, the bacteria grew at the bottom of the tube. Spore formation was suppressed. According to the authors, bacteria such as *B. subtilis* and *B. tuberculosis* do not grow upon the surface because they require oxygen but because surface tension-reducing substances are concentrated at the surface and these are required for the bacterium's metabolism. If, by reducing the surface tension, these substances are diffused throughout the medium, then the bacteria will grow diffusely. Further, they state that if the tension of the medium is reduced, *B. tetani* will grow aerobically, because it can then avail itself of the tension-reducing substances without being exposed to an excess of oxygen. Oil placed upon the surface of a medium is thought to act in this way. P. F.

**Jordan, E. O. Observations on the bacteriology of influenza.** *J. Infect. Dis.*, 1919, **25**, 29.

In this paper the author obtains the same general results as other workers, finding various streptococci and pneumococci in the sputum. Pfeiffer's bacillus was found in 64 per cent. and was more conspicuous than the other organisms, especially when its incidence was compared with the incidence in cases of rhinitis and tonsilitis examined during the same period. The medium used was plain human or sheep's blood agar. Plates should be incubated for three days. 'Heated blood agar plates' in the hands of the author presented no special advantage, but he nevertheless had recourse to symbiotic culture with growth-favouring bacteria when his plain plates were feeble. P. F.

**Dick, G. H. and Murray, E. Studies on the bacteriology of influenza and broncho-pneumonia.** *J. Infect. Dis.*, 1919, **25**, 6.

In addition to the usual streptococci and pneumococci, 63 per cent. of 138 cases yielded *B. influenzae.* Human blood agar was used, and great difficulty was found in isolating the bacilli on this medium unless they were very numerous. Subcultures often failed to grow. (This paper illustrates well the advantage of some of the modern influenza media.—Reviewer.) Eight cases of empyema were examined. In two of these influenza bacilli were found, once alone and once with pneumococci. In 80 cases blood cultures were made and in only two were influenza bacilli found. These two cases were the only instances of recovery of patients with positive blood cultures.

Patients with a pure *B. influenzae* infection showed a leucopenia corresponding to that found to be characteristic for pure 'influenza'.
P. F.

**HARTLEY, P. On the agglutination of *B. influenzae* (Pfeiffer) by the serum of patients suffering from influenza.** *Medical Research Committee, Special Report Series,* No. 36, 1919, 108.

Suspensions of *B. influenzae* grown upon ordinary blood agar or heated blood agar were often unsatisfactory by reason of spontaneous agglutinations. Growths in Matthews' medium were, however, always satisfactory. The tests were maintained at 55°C. for three hours, and then left at room temperature for 24 hours. Macroscopic agglutination only was recorded. Dilution of serum 1 in 50 to 1 in 200. Each serum was tested against several strains.

42 cases were examined and 27 of these agglutinated some strain of *B. influenzae* in a dilution of 1 in 50. Some reacted as high as 1 in 200. The average duration of the illness at the time of collecting the blood was ten days, but the agglutination titre rapidly diminished during convalescence. No normal serum gave positive results. P. F.

**WILSON, W. JAMES. On the occurrence of specific agglutinins for Pfeiffer's bacillus in the blood serum of influenza cases.** *Lancet*, 1919, ii, 607.

Thirty-three cases of influenza with broncho-pneumonia were examined for agglutinins to *B. influenzae.* Eleven showed agglutination and these were still ill. All the negative cases were convalescent. The bacillary suspension was preserved in bulk with 0·1 per cent. formalin or 0·5 per cent. carbolic. The serum was used in dilutions of 1 in 20 to 1 in 160, but all positive cases reacted in 1 in 40 and one in 1 in 1,000. The tests were heated at 50° C. for four hours. Ten persons suffering from diseases other than influenza gave negative reactions even with serum 1 in 2. P. F.

**CLOUGH, MILDRED C. A study of pneumococci reacting with antipneumococcus sera of types I, II, and III, with an observation of a mutation of one of the strains.** *J. Exper. M.*, 1919, **30**, 123.

This paper details a study of nine strains of pneumococci, isolated from cases in the Johns Hopkins Hospital, which were agglutinated by antipneumococcus sera of types I, II, and III.

These nine strains were morphologically typical pneumococci, and on ordinary media showed characteristic growth. Two of them, however, did not ferment inulin, were not completely bile soluble, and caused precipitation in glucose ascitic agar, thus resembling streptococci, but they were regarded as pneumococci on account of their serological reactions. Five out of the nine strains showed little or no virulence for mice.

These nine strains were agglutinated by sera of types I, II, and III in dilutions varying from 1 in 8 to 1 in 64, normal horse serum causing no agglutination.

Active phagocytosis of all the strains was stimulated by treating them with sera of types I, II, and III. No phagocytosis took place in controls treated with normal horse serum.

Precipitin reactions were produced by the interaction of the peritoneal washings of mice inoculated with these stains, and sera of types I, II, and III.

Antipneumococcus sera types I, II, and III protected mice against fatal doses of the virulent strains.

Absorption of sera I and II with the homologous cocci removes the agglutinins for all the strains, but absorption with the individual strains under examination does not remove the agglutinins for types I and II pneumococci respectively.

One of the nine types examined when first isolated was an atypical type II pneumococcus. After six months' cultivation it changed its characteristics in so far as it ceased to ferment inulin and became bile insoluble; at the same time it became actively agglutinated and phagocytosed when treated with sera of types I, II, and III. By animal passages this strain reverted abruptly to its original form.

The suggestion is made that this mutation indicates that strains of pneumococci reacting with all three types of sera may represent primitive forms from which the fixed types have arisen. G. T. W.

**NAUWERCK.** Gasbrand (malignes Oedem) nach subkutaner Injektion. [**Gas gangrene (malignant oedema) after subcutaneous injection.**] *München. med. Wchnschr.*, 1918, **65**, 945.

**FRAENKEL, EUGEN.** Die blutschädigende Wirkung des Fraenkelschen Gasbazillus. [**On the injurious action of Fraenkel's gas bacillus on the blood.**] *Deutsche med. Wchnschr.*, 1919, **45**, 317.

**ROSENBERG, S.** Zur Frage des Gasbrandes. [**On gas gangrene.**] *Deutsche med. Wchnschr.*, 1919, **45**, 410.

**OSTROWSKI, S.** Ueber die Entstehung von Gasbrand nach Koffeininjektionen. [**On the origin of gas gangrene after injections of caffeine.**] *Berl. klin. Wchnschr.*, 1919, **56**, 779.

**NEUMANN, JACQUES.** Foudroyante Gasphlegmonen nach subkutanen Koffeininjektionen. [**Fulminating gas phlegmon after subcutaneous injections of caffein.**] *München. med. Wchnschr.*, 1919, **66**, 900.

The pathological interest in these papers lies in the fact that they relate to thirteen persons who succumbed to the most fulminant type of gas phlegmon following the subcutaneous injection of solutions of caffein alone or in association with sodium salicylate. Either during life or after death Fraenkel's gas gangrene bacillus (*B. welchii*) or *B. oedematis maligni* were found in most of the cases. In Nauwerck's case, which was a woman aged 44, suffering from coronary sclerosis and fibrous myocarditis, an injection was given in the right thigh of 1 c.c. of a mixture camphor oil and caffein dissolved in sodium salicylate solution. Within 24 hours there was an enormous crepitating gas oedema over the whole thigh, death taking place in 50 hours. After death a spread of the emphysema took place over the whole body except the head, and the heart was blown out and full of gas. The description of the anaerobic bacilli corresponds with that of *B. oedematis maligni* (*Vibrion septique*). Nauwerck found that in doses of 1 c.c. the caffein-salicylate solution killed guinea-pigs with malignant oedema. The source of the infection of the drug was not elucidated. The solution had been sterilized in a steamer for 20 minutes.

Fraenkel's three cases, which were two males and one female, of the respective ages of 39, 22, and 19, were suffering from pneumonia, but otherwise in good condition. They all died within 24 hours of *foudroyant* gas phlegmon following the subcutaneous injection of 'sterile' caffein solution. The deaths took place in February, May, and December. The lesions contained enormous quantities of gas phlegmon bacilli as previously described by Fraenkel. Of Rosenberg's cases one was a Russian prisoner of war with severe typhus fever. An injection of a sterile solution of caffein and sodium salicylate by an orderly was followed by death from gas phlegmon in 24 hours. After death only streptococci were grown in culture. No contamination of the remaining ampoules of the solution could be determined. In his second case, one of scarlet fever and heart weakness, 0·02 c.c. of caffein-salicylate solution was injected after the skin of the thigh had been iodized. Intense jaundice, haemorrhagic rash and haemoglobinuria associated with enormous crepitating swelling of the thigh caused death in 40 hours. *B. oedematis maligni* was said to be cultivated from the lesion.

Two of Ostrowski's patients were Russian prisoners thoroughly worn out with starvation, oedema, and haemorrhagic diathesis. The one died in 24 hours, the other in 28 hours after an injection of caffein. The one case showed malignant oedema bacilli, the other Fraenkel's bacillus. Ostrowski's third patient was a German with double influenzal pneumonia. He was injected both in the arm and leg and died in 20 hours with jaundice, cyanosis, haemoglobinuria, and gas phlegmon which contained Fraenkel's bacillus. The fourth case, a soldier with typhoid on the Russian front, died with gas phlegmon in 30 hours. Fraenkel's bacillus was found in the lesions but not in the injection material. This material was made up of caffein and sodium salicylate dissolved in water, and sterilized. The syringes were also sterilized, and the site of injection swabbed with alcohol on sterile gauze.

Neumann's three cases were young males suffering from very severe influenza-pneumonia. After subcutaneous injection of a 20 per cent. sol. of caffein-sodium salicylate death took place in a very short time from diffuse crepitating gas phlegmon. Fraenkel's gas bacillus was demonstrated in the lesions. The solutions of caffein were proved to be sterile. These alarming sequelae to infections of caffein and sodium salicylate are not entirely cleared up. In some cases the dirty condition of the patients (starving prisoners of war) would account for the accident. In other cases the finding of anaerobic bacilli in the solutions indicates that spore-bearing types probably resisted the degree of heating assumed to have produced sterility. The possibility of damage to the tissues, especially the fasciae or even muscle, is emphasized by Ostrowski, and is considered by him to have created a possible nidus for the growth of anaerobes. It will be remembered that, long ago, Brieger and Ehrlich described malignant oedema following tincture of musk. Tetanus following apparently sterile solutions of quinine is also well known, and Nigst (vide *Med. Science*, 1919, **1**, 144) has recorded a case following the injection of camphor. W. B.

**Weil, S.** Experimentelle Untersuchungen über die Bedeutung der Gewebsquetschung für die Pathologie und Therapie des Gasbrandes. [**Experimental researches on the importance of crushing of the tissues for the pathology and therapy of gas gangrene.**] *München. med. Wchnschr.*, 1919, **66**, 1046.

Short account of experiments in which *B. oedematis maligni* and bacillus of Fraenkel were injected into the normal or crushed muscles of guinea-pigs and rabbits. Culture doses which were inert in the case of uninjured animals determined a fatal issue when injected into muscles which had been crushed by forceps. This confirms the well-known fact that healthy tissues offer a considerable resistance to the growth of the anaerobic bacteria found in gas phlegmon. It was also found that gas gangrene sera have little protective effect in animals in which the microbes have been implanted into crushed muscles. Experiments made with members of what the Germans call 'putrificus group' were non-pathogenic. W. B.

**LOCKEMANN, G.** Welche Nährstoffe sind für das Wachsthum der Tuberkelbazillen unbedingt notwendig? [**What substances are absolutely necessary for the growth of tubercle bacilli?**] *Centralbl. f. Bakteriol.* (&c.), 1919, I. Abt. Orig. **83**, 420.

The composition of simple media for the growth of tubercle bacilli has for long been extensively studied. In 1894 Proskauer and Beck arrived at the conclusion that the simplest medium on which tubercle bacilli would grow had the following composition. Ammonium carbonate 0·35 per cent., primary potassium phosphate 0·15 per cent., magnesium sulphate 0·25 per cent., and glycerine 1·5 per cent. In 1913 E. Löwenstein stated that he had obtained growths on a much simpler medium composed only of 0·6 per cent. of ammonium phosphate, and 4·0 per cent. of glycerine. Lockemann, in the present publication, reports that he failed to get any growth, however, on this medium, and compares it with a simple medium devised by himself and consisting of—

| | | |
|---|---|---|
| 3·0 | grm. | monosodium phosphate ($NaH_2PO_4$, $H_2O$) |
| 4·0 | „ | monopotassium phosphate ($KH_2PO_4$) |
| 0·6 | „ | magnesium sulphate ($MgSO_47H_2O$) |
| 2·5 | „ | magnesium citrate |
| 5·0 | „ | asparagin |
| 20·0 | „ | Glycerol to 1 litre of water. |

On this, a good growth of tubercle bacilli was obtained. Variations in the composition of the medium were made the subject of experiment, and he ultimately concluded that in addition to glycerine a nitrogen containing simple compound, preferably asparagin, was necessary in addition to phosphoric acid, potassium, and magnesium salts. Citric acid was an important, but not necessary, adjuvant. Sodium, calcium, and sulphuric acid could apparently be dispensed with. W. B.

**EMBLETON, D.** and **STEVEN, G. H.** **Meningococcus carriers.** *J. Roy. Army Med. Corps*, 1919, **33**, 312.

Meningococcus carriers may be divided into 'temporary' and 'chronic'; 80 per cent. belong to the former group, who remain 'positive' for an average of 24 days. Chronic carriers, however, persist for 5½ months. The longest period observed was 634 days. Once only in 905 carriers did the 'type' of meningococcus in the nasopharynx change. Treatment with all recognized antiseptics applied in inhalation chambers or with hand sprays had no beneficial effect; on the contrary, the rate of discharge among such men was slower than among casually treated men. Towards the end of the carrying period, the meningococcus often becomes displaced by non-agglutinable meningococci, which were reported 'negative' because only cocci agglutinating with 'type' sera, officially supplied, were classed as meningococci. These non-agglutinating colonies are very common; 20 per cent. of those selected from the naso-pharynx failed to agglutinate, and also a number from the cerebrospinal fluid. The great majority of the inagglutinable strains are true meningococci. P. F.

**Dragstedt, L. R., Dragstedt, C. A., McClintock, J. T.,** and **Chase, C. S. Intestinal obstruction. II. A study of the factors involved in the production and absorption of toxic materials from the intestine.** *J. Exper. M.*, 1919, **30**, 109.

In their second contribution on the subject of intestinal obstruction the authors report the results of their investigations on the factors involved in the production and absorption of toxic materials from the intestine. After a short historical review of previous experiments, they give details of their own investigations. The method employed in all the operations is to form a closed loop in the small intestine of dogs, with reconstruction of the lumen of the bowel, by anastomosis. They show—

1. That, in the great majority of cases, the dogs in which a simple loop is thus shut off develop the symptoms of a rapid toxaemia, with distension and even perforation of the loop, the contents of which resemble the products of acute intestinal obstruction of clinical type.
2. That if the loop be previously washed with water and ether, about 50 per cent. of the animals survive indefinitely, and the mucosa of the loop remains normal in appearance, although the contents show a great number of bacteria. From this is deduced that, although the ether does not sterilize, it must have some effect upon the mucosa, probably by a coagulation of the cell protoplasm.
3. Many other substances, including strong antiseptics, were used, and in many cases had the same effect as ether, but never acted as efficaciously as ether itself.
4. The contents of the closed loops, even when causing no adverse symptoms in the host, were rapidly fatal when injected into other animals.
5. Astringents used to wash the loops were as useful as antiseptics.
6. If the closed loop, which had been giving rise to no symptoms, was at subsequent operations injected with magnesium sulphate to produce a distension, the contents were rapidly absorbed and the animal died. This shows that the distension is an all important factor in the absorption of the toxic materials, probably by interference with the normal blood supply.

The authors conclude, from the experiments:

1. It is impossible to sterilize a loop of intestine.
2. The toxic materials are always the result of bacterial action, and not due to a special activity of the cells of the mucosa.
3. That injury to the mucosa by distension or cutting off of blood supply greatly facilitates the absorption of the poisons.

In considering these experiments from a surgical point of view it must be remembered that a closed loop, with undisturbed blood supply, is never presented to the surgeon. The intense rapidity of the symptoms in a case of intestinal strangulation must be accounted for to a certain extent by the actual physical obstruction to the lumen of the gut and to the immediate occlusion of the vessels at the point of obstruction. L. J. A.

**Hilgers, E. W.** Pseudodysenteriebazillen als Erreger von Cystopyelitis. [**Pseudodysentery bacilli as a cause of cystopyelitis.**] *Centralbl. f. Bakteriol.* (&c.), 1919, Abt. I. Orig. **83**, 414.

**Fraenkel, Ernst.** Untersuchungen über die Pseudodysenterie (Y-Ruhr). [**Researches on pseudodysentery (Y dysentery).**] *Deutsche med. Wchnschr.*, 1915, **41**, 1182.

**Foerster, Alfons.** Ein Fall von Zystopyelitis hervorgerufen durch Ruhrbazillen (Typus Flexner). [**A case of cystopyelitis caused by dysentery bacilli (type Flexner).** *München. med. Wchnschr.*, 1918, **65**, 205.

Hilgers examined the urine of 82 cases affected with cystitis, and found *B. coli* in 51, although 9 of these gave, at first, blue colonies on Drigalski plates, and only in sub-cultures unmasked themselves as *B. coli.* There were 4 infections of *B. lactis aerogenes*, 2 of *B. faecalis alkaligenes*, 1 of proteus, and 22 of staphylo- and streptococci. There remained 2 cases infected with pseudodysentery bacilli. They were Gram-negative, non-motile, non-liquefying rods, producing no gas in dextrose, no coagulation in milk, and producing acid in maltose, sucrose, and mannitol. One of the strains produced indol, while the other did not. They were tested with all the pseudodysentery sera of Kruse, in whose laboratory the work was carried out. With Kruse's serum 'A' one of the strains was agglutinated to titre (1 : 5,000), and absorption experiments confirmed the view that the bacillus isolated corresponded to Kruse's 'A'.

The second strain, by agglutinating and absorption tests, was shown to correspond to Kruse's type 'H'.

Sera made by inoculating rabbits with each of the two bacilli isolated from the urine agglutinated Kruse's types 'A' and 'H' respectively, and absorption tests confirmed this diagnosis. The strain 'A' was isolated from a man with chronic prostatitis, while strain 'H' came from a child suffering from enteritis follicularis. Dysentery bacilli have also been found in the urine by Ernst Fraenkel and by Foerster. Fraenkel's series consisted of 3 cases of Y dysentery, one of them being associated with typhoid bacilli. Foerster's case was one of infection by Flexner's bacillus. W. B.

**Doerr, R. u. Schnabel, A.** Experimentelle Untersuchungen über Infektion und Immunität bei Fleckfieber. [**Experimental researches on infection and immunity in typhus fever.**] *Wien. klin. Wchnschr.*, 1919, **32**, 523, 891.

Although hygienic measures are of great advantage in quelling epidemics of typhus fever, the authors point out that a really effective method of inoculation, such as occurs in the case of vaccination against variola, would probably have a much greater effect, and although their careful experiments up to date have yielded only negative results, such results are worthy of record. In spite of many different attempts, they have not succeeded in protecting guinea-pigs with certainty against a massive dose of typhus 'passage virus'. The means they employed were inoculations of virulent organs from typhus guinea-pigs, infected lice, the material of inoculation being treated by phenol (0·1–0·5 per cent.) or rapid desiccation or prolonged standing. The experiments are described in detail. According to their present view the authors consider that a durable active immunity is only to be obtained by the multiplication of the virus in a susceptible organism as attenuated or dead virus is without effect. The occurrence of virulicidal antibodies plays a subsidiary part and is a transient phenomenon.
W. B.

**Doerr, R.** u. **Kirschner, L.** Beitrag zur Diagnose der Fleckfieberinfektion beim Meerschweinchen. [**Contribution to the diagnosis of typhus fever in guinea-pigs.**] *Med. Klin.*, 1919, **15**, 894.

During the war the pathological anatomical study of material from cases of typhus fever showed that there are characteristic histological changes in the small vessels along with perivascular cell nodules (E. Fraenkel, Ceelen, Benda, Aschoff, Herzog), and it is now admitted that these are almost specific. According to Herzog, the perivascular nodules do not occur before the ninth day of the illness, i. e. from 17–19 days after infection. Doerr and Kirschner confirm the observations of Otto and Dietrich, Grzywo-Dabrowski and Kuczynski, that similar lesions occur in guinea-pigs suffering from experimental typhus. The lesions are specially marked in the brain and do not occur in healthy guinea-pigs or in those dead from diseases other than typhus. They were also not found in rabbits. The cell masses occur after intraperitoneal inoculation of 'passage virus' on the sixth day, i. e. soon after the onset of the fever. They last throughout the febrile period, and may persist after the disappearance of the virus as judged by inoculation. They may occur in all parts of the brain, but are specially marked in the medulla. They are found in connexion with capillaries or precapillary vessels which are frequently thrombosed. The endothelium shows definite alterations. The origin of the virus (man, louse, guinea-pig) is a matter of indifference. As, however, the nodules are absent in 15–20 per cent. of guinea-pigs certainly affected with typhus, the failure to find the nodules is no evidence of the absence of typhus, which may be established by the incubation period, the rise of temperature, and subsequent active immunity. W. B.

**Remlinger, P.** Contribution à l'étude de l'hérédité de la rage. [**Contribution to the study of the inheritance of rabies.**] *Ann. de l'Inst. Pasteur*, 1919, **33**, 375.

**Konrádi, D.** (1). Ist die Wuth vererbbar? [**Is rabies heritable?**] *Centralbl. f. Bakteriol.* (&c.), 1905, Orig. **38**, 60.

**Konrádi, D.** (2). Ist die Wuth vererbbar? Ist das Blut Lyssakranker infektionsfähig? [**Is rabies heritable? Is the blood of cases of rabies infective?**] *Centralbl. f. Bakteriol.* (&c.), 1908, Orig. **47**, 203.

**Konrádi, D.** (3). Hérédité de la rage. [**Inheritance of rabies.**] *Ann. de l'Inst. Pasteur*, 1916, **30**, 33.

On the ground of older observations it has generally been asserted that the virus of rabies occurs but rarely in the blood; the demonstration of the transmission of the disease from the mother to the foetus through the placenta shows however that it must occur at any rate occasionally, for as long ago as 1887 Perroncito and Carita showed that the central nervous tissue of rabbit foetuses removed from a rabid mother could communicate the disease when inoculated subdurally. Loir (1903) showed the same thing. In a human case of rabies Krokiewicz (1902) failed to get a positive result. In 1905 D. Konrádi showed that more constant positive results were obtained with guinea-pigs, although the virus appeared to have become attenuated, as was shown by the great prolongation of the incubation period, which in one case lasted 465 days.

Remlinger, in an extensive study, has worked along the same lines, and has shown that a conceptional rabies does not occur, the transmission from parent to offspring being placogenic. This passage through the placenta may take place under three conditions, analogous in many ways to that which obtains in the case of variola and syphilis.

1. After the death of an animal from rabies the uterus is found to contain foetuses, the inoculation of the brain of which induces rabies.

2. Some days before death from rabies an animal throws young which develop the disease and die.

3. After inoculation with rabies, an animal gives birth to young, which appear to be healthy, and may live for weeks, or even months, although they ultimately succumb to rabies. During this time, and for long after their death, the mother may remain well, although she ultimately dies of the disease. This was the condition emphasized by Konrádi and now confirmed by Remlinger, and it may be utilized to explain the undoubted and mysterious instances in which human beings have developed rabies from the bite of a dog which was not apparently rabid, and which has actually survived its victim. Several dogs in the same litter, or even a whole litter, may be attacked simultaneously with rabies, although the mother was well and did not die of the disease for a long time, or even not at all. These facts go far to explain why rabies may occur in animals not known to have been bitten by a rabid animal, and the diagnosis of rabies cannot be excluded by the fact that a dog could not have been bitten by another. It is known that some dogs cannot be successfully inoculated with rabies, and in the above experiments there is a possible explanation if one assumes that the virus may traverse the placenta in an amount insufficient to produce the disease, although immunity may be set up. There is reason to believe also that in certain cases the rabies virus may long remain latent before manifesting its pathogenic effects. Indeed, as Remlinger suggests, the ultimate nervous symptoms may not be those hitherto regarded as pathognomonic of rabies. W. B.

**NORRIS, DOROTHY. A further note on the preparation of culture media suitable for the growth of organisms used in vaccines.** *Indian J. M. Research*, 1919, **6**, 569.

This paper is a continuation of some experiments described in a previous communication (Norris, *Indian J. M. Research*, 1918, **6**, 174), on the factors responsible for the growth of *B. typhosus*. Attempts have been made to specify the conditions that are necessary for optimum growth, and the results so far obtained are embodied in this paper. *B. typhosus* and trypsinized medium have been used throughout the experiments.

The points investigated were as follows:

1. Optimum percentage of substrate for hydrolysis by trypsin. The author had previously pointed out that this factor appeared to be of more importance than the duration of hydrolysis. The following points seem to have been established:

(*a*) Using a 10 per cent. substrate, the substances required by the organism appear to be formed during the early stages of hydrolysis and continued digestion does not yield a proportionately more efficient medium.

(*b*) A prolonged hydrolysis of a 1 per cent. nutrose substrate does not provide the necessary substances, nor are these formed in sufficient quantity from such a substrate during the first hours of digestion.

2. Duration of hydrolysis.

If crushed soya bean is used as a substrate for digestion it appears to be possible to hydrolyse this beyond its optimum nutritive value showing that prolonged hydrolysis is unnecessary.

3. Action of varying concentrations of enzyme on the course of hydrolysis.

Experiments made on this point were found to be in agreement with the general laws of enzyme action, namely, that a maximum amount is soon reached, after which any further increase appears to have but little effect.

4. Action of reinforcement of the enzyme during the later stages of hydrolysis.

Experiments were tried with both concentrated and dilute substrates. Little difference in nutritive value was observed.

5. Effect of temperature of sterilization on the nutritive value of media. This appeared to influence its nutritive value, a high temperature being more detrimental than a low one.

6. Effect of temperature on hydrolysis. Within limits this did not exercise any great influence on the nutritive power of the medium subsequently obtained.

7. Optimum degree of hydrolysis of medium for a growth as determined by Sörensen's method of estimation of amino-acids. All hydrolyses which have given a small yield of amino-acids have afforded poor growths of *B. typhosus.* On the other hand a large yield of amino-acids did not necessarily imply a good nutritive medium.

8. Constitution of the protein hydrolyzed with reference to the production of the necessary amino-acid constituents for growth.

It was found that the hydrolysis of seeds from maize does not result in the production of an efficient medium.

9. Comparison of various media as regards yield of bacteria.

It was found to be quite possible to obtain good results, using a purely vegetable basis, although none of these equal the results obtained with pancreatic extract and casein.

10. Use of enzymes other than trypsin for hydrolysis.

Peptic digestion did not yield the substances necessary for the growth of *B. typhosus* under the conditions tried. W. A. M. S.

**McKendrick, A. G. Theory of invasion by infective agents.** *Indian J. M. Research*, 1919, **6**, 614.

The important communication by the Director of the Pasteur Institute of India is of the nature of a note which describes the above theory and a few of its applications to the more prominent features of organismal invasions. These features, which the author uses later as criteria of the sufficiency or insufficiency of his theory are as follows:

1. Relapses. The relapsing character of protozoal diseases is known to be due to the cyclic life history of the organism. Its rate of multiplication is therefore periodic and is shown in the well-defined oscillatory character of the symptomatic picture. In diseases in which multiplication takes place on a surface similar oscillations might occur. In some cases there are an indefinite number of relapses, and the organism has no definite life-cycle as in Malta fever.

2. Terminations. The extremes of termination by 'crisis' and the

'chronic' infection are alluded to. Also between these extremes there is the 'carrier' phenomenon which is considered.

3. Effects of dead organisms and vaccines. Here there is a reference to vaccine therapy and the 'negative phase'.

4. Applicability to protozoal infections.

The above manifestations are quantitative and in connexion with them he uses the terms prolificity, avidity, resistivity, acceleration, and reactivity. His considerations regarding the formation of antibodies are summed up as follows: 'The introduction of organisms (or their products) into the body system causes an acceleration in the rate of production of antibodies. It is reasonable to assume that the degree of response is proportional to the logarithm of the stimulus, and to the tissue reactivity. The stimulating power of an organism (or its products) probably depends upon its degree of saturation (sensitization).' The various reasons for the adoption of a logarithmic law are stated in the text. The laws assumed are all quantitative and can be expressed in two equations which are given in an appendix. The solutions of these equations are expressed in the form of graphs. These for the number of organisms and quantity of antibodies are oscillatory with several characteristics.

(*a*) The centre about which the oscillation occurs either rises or falls to a definite final level.

(*b*) The oscillations are either 'damped' or 'magnified'.

(*c*) The antibody curve is of the usual sinuous type.

(*d*) The curve of a number of organisms is also sinuous, but with wide valleys and abrupt summits.

(*e*) There is a lag between the curves. That of the antibody lags behind the organism curve to the extent of roughly a quarter of a period.

A graduated series of curves is shown in which the protective body forces, greatest at the head of the series, gradually decreases from above downwards, representing different types of bacterial infections, pneumonia, Malta fever, typhoid (with and without relapse), and chronic infection.

The author then proceeds to consider in detail the features of these curves with reference to termination, relapses, and other characters. The question of the effects of dead vaccines is next taken up. Calculated curves are given of the variation in quantity of antibodies after a single dose of a dead vaccine. The above considerations are then extended to include temperature charts. It is assumed tentatively that the main characteristics of the curves above described appear also in the febrile curves—the same periodicity and termination, but not necessarily the same phase. From the equations arising out of the hypotheses adopted, the maxima and minima of organism content occur at times which correspond to the points of intersection of two curves, a sine curve—with an exponential. Illustrations are given together with deductions relating to the prognosis in each case.

**Mathematical appendix.** The following is a brief summary of the equations adopted. Let $y$ be the number of organisms, $z$ the antibodies, $k$ the prolificity, $m$ the avidity of the protective tissue, $c$ the general katabolic activity, and $l$ the reactivity.

The rate of variation of organisms is given by $Dy-ky+myz=0$

The rate of variation of antibodies, on account of wastage factors only, is given by $Dz+cz+myz=0$

If a stimulus is introduced then this becomes

$$D^2 z + cDz + mD(yz) = l \log \text{(stimulus)}.$$

The stimulus is assumed to be of the form $y/exp\ (nz)$, $n$ being a factor corresponding to chemical valency. Writing $x$ for $\log y$ he obtained the equations

$$D^3 x + cD^2 x + lnDx + lmx = knl + m^2 D(yz)$$
$$D^3 z + cD^2 z + lnDz + lmz = kl - mD(yz)$$

Now $mD(yz) = [(k - Dx)Dx - D^2 x]\ exp\ x$, which to a first order of approximation equals $kDx - D^2 x$.

Finally we thus have

$$D^3 x + (c+m)D^2 x + (ln - km)Dx + lmx = knl$$
$$D^3 z + (c+m)D^2 z + (ln - km)Dz + lmz = kl$$

The solutions of these are well known (see Routh's advanced Rigid Dynamics).

It does not seem clear how these equations are arrived at, and more details are desirable. The paper is, however, one we welcome, and further researches of this kind might be undertaken especially in the statistical examination of fever charts. The mathematical knowledge required, however, is considerable. W. A. M. S.

## RADIOLOGY

### *Radiography*

**Weinberger.** Zur Klinik der rechtseitigen Zwerchfellhernien. [**Diaphragmatic hernia.**] *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1918, **25**, 381.

Formerly diaphragmatic herniae were but rarely diagnosed during life. Leichtenstern, who published the first clinically diagnosed case, said that of 245 cases mentioned in literature only four times had the definite or probable diagnosis been made at the bedside. With the advent of radioscopy the conditions have changed. W. describes a case in which the clinical signs and symptoms were peculiar and led to radiographic examination. The negative showed an absence of the diaphragmatic shadow on the right side and its replacement by an irregular shadow reaching up as high as the fourth rib. This shadow might have been occasioned by some pleural exudation or intra-pulmonary consolidation, and so far the radiograph was inconclusive; but administration of a bismuth meal led to the discovery of a considerable coil of large intestine in the right thoracic cavity. Since diaphragmatic herniae resulting from gunshot wound are becoming the subject of operative treatment (v. Domarus and Salomon describe 12 cases of operation on chronic free herniae with two deaths) the matter is not merely one of academic interest. W. S. L-B.

**Ponzio.** Radio-diagnostic des cystes hydatiques du poumon. [**Pulmonary hydatid cysts diagnosed radiologically.**] *Radiol. méd.*, 1917, **4**, 225. (*J. de radiol. et d'électrol.*, 1917, **2**, 719.)

Description of a case of hydatid cyst of the lung diagnosed radialogically. In these cases the pulmonary tissue shows a homogeneous, rounded shadow with even opacity and sharply defined limits. Sometimes the shadow is reduced to a dark well-defined ring formed by the wall of the cyst with the surrounding compressed and consolidated lung-tissue. This is especially the case when the cyst has been partially or completely evacuated by rupture into the bronchi. Under these circumstances air may replace the evacuated fluid and give rise to the general impression of a saccular hydro-pneumothorax (a diverticulum incompletely filled with a mobile liquid surmounted by gas). W. S. L.-B.

**Desplats** et **Raynal.** Étude radiographique du rhumatisme lombaire chronique : la lombarthrite et la spondylose ankylosante. [**Chronic lumbar rheumatism.**] *Arch. d'électric. méd.*, 1918, **26**, 342.

Amongst the numerous patients sent for radiological examination who complain of conditions referable to the lower dorsal or lumbar spine the authors have separated out a class in which there is to be seen, radiologically, a diminution in thickness of the intervertebral disc with flattening of the opposing sides of the vertebral bodies involved, so that the bodies of contiguous vertebrae are situated abnormally close to one another. To this condition is often added the formation of bony spurs from the edges of the vertebra, and sometimes the actual production of bony arches uniting adjacent bodies. In the first class of case the vertebral column is mobile, whereas in the second it is not. The first (mobile) variety corresponds to the lumbar arthritis of Leri and appears to be curable, the second (ankylosing) variety appears to get progressively worse. The relation between the two is uncertain. W. S. L.-B.

**Béclère, H.** La radiographie anthropométrique du pouce (superposition des empreintes digitales du squelette et de l'ongle. [**Anthropometric radiography of the thumb (superposition of the phalanges and the nail.**] *Compt. rend. Acad. d. Sc.*, 1918, 30 Sept. (*J. de radiol. et d'électrol.*, 1919, **6**, 282.)

This work is of interest both from the anatomical and anthropometrical points of view. The nail grooves are powdered with lead oxide, the excess being removed by swabbing with cotton wool soaked in mineral oil. The skin on the palmar aspect is lightly smeared with vaseline or lanoline and oxide of lead.

The radiogram is taken with rays of 5-6 Benoist and with a Coolidge tube by preference.

In the thumb the central ray passes through the middle of the base of the nail and the digit placed without pressure on an X-ray plate, $4\frac{1}{2}'' \times 6''$ size. Anticathode plate distance 40 cm. Current 10 m.a. Exposure 3 seconds.

The grooves and outline of the nail superimposed on the phalangeal shadow are thus obtained. It is found that the outline of the nail varies with each individual, while the outline of the matrix and edges appears constant for the same individual.

The relation of the skin ridges to the bone varies from one individual to another. R. W. A. S.

**GANGELE.** Zur Anatomie und Röntgenologie des oberen Femurendes bei der angeborenen Hüftgelenksverrenkung. [**The anatomy and radiology of the head of the femur in congenital dislocation of the hip.**] *Zeitsch. f. orthopäd. Chir.*, **1**, **2**, 28. (*Centralbl. f. Chir.*, 1918, **46**, 92.)

It is only with an intimate knowledge of normal conditions that the pathological conditions of the skeleton in childhood and in adults can be studied; they can be amplified and verified by means of radiographs. The results of extensive investigation show that normally the axis of the head of the femur is hardly ever directed absolutely forward: torsion of the upper half of the femur from within forward is physiological. Hence, estimation of the amount of ante torsion becomes a differential diagnostic indication in cogenital dislocation and in its treatment. There is no congenital coxa vara in the dislocated hip; only after fracture of the neck of the femur can coxa vara supervene; and then only during the after-treatment. Cases may be considered of this nature on the basis of falsely interpreted radiographs. The only reliable indications are in the head and neck of the femur in the shape of flattening and polishing, as well as atrophy of the whole of the region of the hip-joint. After reduction of the dislocation, the manifestations that occur gradually and later are inflammatory in nature, and the result of injury (arthritis deformans?) occurring during the reduction; these late changes must be guarded against by proper and careful treatment. S. L.-B.

**CHEVRIER.** Étude sur le drainage de la plèvre. Traitement de choix des pleurésies purulentes (stérilisation clinique par les gaz et les vapeurs antiseptiques). [**Drainage of the pleura.**] *Presse méd.*, 1919, ii, 9. (*Arch. d'électric. méd.*, 1919, **27**, 29.)

Considering different positions of the patient and the level of the pleural effusions in sections, the author investigated the logical basis of local drainage of the pleural cavity. After having indicated by very clear diagrams the exact level of the pathological costo-diaphragmatic cul-de-sac, the author seeks to find which are the methods able to show it with certainty. Two only were found: the method of graduated punctures and radioscopy. He indicates the difficulty of the former method, it being possible that the needle may be entirely in the cul-de-sac, while little or no fluid is evacuated; the lower the puncture is made, the thicker and more sedimented the pus.

The author thinks that radioscopy does not permit one to specify exactly the bottom of the costo-diaphragmatic cul-de-sac in the angulo-costal or the costo-vertebral line. The reasons are as follows: the costo-vertebral groove is difficult to explore in an oblique position, because of the shadow of the vertebral column; a completely drained puncture being impossible, the few remaining cubic centimetres of liquid or of clot will always cast a shadow on the bottom of the latero-vertebral groove, and, on the right side, will not allow one to judge the exact limit of the pleural cavity, even after an injection of air, because of the opacity of the liver.

The author's conclusion is that radioscopy, though it may render great service in enabling us to tap the effusion nearer to the base of the pleura—which it is granted is a matter of very great importance—cannot enable us to make an accurate determination of the exact level of the lowest point of the pleural cavity on the thorax in the angulo-costal line.

Bergonié (who makes the abstract) considers that the author's criticism bears upon a detail that depends upon the skill of the radiographer and the technique of radioscopy. In many cases, he thinks that determination of the exact level of the pleural base, in the angulo-costal line as well as in the other lines, is by no means impossible. S. L.-B.

## *Radio-technique*

**KLEINSCHMIDT, K.** Ein neues Entwicklungsverfahren für halbe und Viertel-Exposition der Röntgenplatten. [**A new method of developing under-exposed Röntgen plates.**] *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1919, **26**, 150.

The comparatively long exposure necessary to obtain a photograph showing great detail entails the risk of fogging through the presence of secondary rays, whilst if the exposure is shortened the negative is somewhat spoilt by having to be developed for a long period. To obviate this the author has prepared an accelerator, which, when added to ordinary developer, produces a good photograph even though the exposure has been one quarter of the normal. J. R. C.

**GLOCKER, R.** Über Absorption und Streuung der Röntgenstrahlen. II. [**The absorption and scattering of Röntgen rays. II.**] *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1918, **25**, 470.

The extent of the scattering of Röntgen rays by matter depends on the thickness of the layer traversed in the same way as does the absorption, and the quantity evaluated in absorption measurements is the sum of the coefficients of absorption and scattering. In addition to scattering the rays, many substances also excite a characteristic radiation, and when a filter is employed to obtain hard rays, this soft characteristic radiation must be reduced to a minimum. It is shown that, if two filters be employed, one of zinc and the other of aluminium, each of which absorbs the same percentage of the primary beam, then the secondary radiation emerging from the two filters is of nearly the same intensity, but in the first case it is composed chiefly of characteristic radiation, and in the second of scattered radiation. The best filter obtainable with these two metals is a combination, in which a thin sheet of aluminium, placed next to the patient, absorbs the characteristic zinc radiation, and is not thick enough to produce much scattering.

It is calculated that the increase of dosage, when radiating a deep-seated tissue, as a result of scattering in the upper layers, attains a maximum of 40 per cent. when the radiated tissue is 7 cm. deep and 67 per cent. when it is 14 cm. deep, and thus is not negligible when the hardest rays are employed. On the other hand, the increase is not sufficiently great to account for the very good clinical results obtained with the use of hard rays. This leads to the conclusion that Röntgen rays of great hardness have a particularly great biological action. This is to be expected if the action of the rays on the tissue is due to the production of electrons. The velocity of these will increase with the hardness of the rays and so will have a greater effect.

It is shown that, even having regard to the additional dosage caused by scattering, Christen's half-value rule is nearly valid, however hard the rays. J. R. C.

**Weill, E.** and **Mouriquand, G.** Action des rayons X sur les grains d'orge et carence. [**Action of X-rays on seeds.**] *Compt. rend. Soc. de biol.*, 1918, **81**, 1107. (*Arch. d'électric. méd.*, 1919, **27**, 58.)

The authors are seeking to find out if heavy doses of X-rays, capable of disturbing the germinative power of the seeds, deprive them of their power against beri-beri. Groups of seeds receive, some 50 H, some 100 H, some 150 H. The first lot germinate normally with a slight advance; the second lot sprout rather badly; the grains having received 150 H germinate slowly or not at all. The pigeon, it is known, is very sensitive to deprivation of fresh seed; and when fed upon barley sterilized by heat, the symptoms of beri-beri appear from the 25th to the 35th day. None of the pigeons fed on irradiated seed showed any signs of trouble, and the weight-curve of the animals was unaltered, indicating that the nutritive value of the seed was not modified. There exists, however, a type of beri-beri which is slow in making its appearance (250 to 300 days). It is necessary to allow this period to elapse, in order to prove positively the absence of X-ray action on the seeds. However, the extreme sensitiveness of the pigeon renders this conclusion most probable. S. L.-B.

## *Electrotherapy*

**Latarjet** et **Promsy.** De l'action antiseptique de l'ionisation dans les plaies de guerre. [**The antiseptic action of ionisation.**] *Compt. rend. Soc. de biol.*, 1918, **81**, 1230. (*Arch. d'électric. méd.*, 1919, **27**, 28.)

The authors tried to sterilize wounds in cases of severe fracture by electrolysing with a weak current solutions capable of forming iodine or chlorine. The active electrode made of absorbent cotton wool soaked in the chosen solution (physiological salt solution, or solution of iodide of potassium) was placed directly on the wound and all its irregularities were carefully filled. It was connected with the negative pole. The seances lasted thirty minutes, an hour, or more; the intensity employed varied from 1·5 to 6 milliampères. The passage of the current causes neither pain nor burning. The applications were repeated every day or every other day. The twelve cases reported by the authors show the remarkable efficacy of the treatment. Whether the action be due to the penetration of ions or to the indirect influence of the current on the tissues or the secretions, sterilization is incontestable. Streptococci disappear after a few seances, even though they have been present in the wound for weeks. Staphylococci and *B. perfringens* are non-resistant: other bacteria disappear or decrease fairly rapidly. Sanious wounds granulate actively, the purulent secretions dry up, oedema recedes. The authors think the duration of the seances is the only drawback, but in view of the importance of the results obtained, this is a point not worth considering. S. L.-B.

**Fabre.** Anesthésie à la 'brûlure faradique' dans les lésions des nerfs périphériques. [**Use of 'faradic heat' in lesions of the peripheral nerves.**] *J. de méd. de Bordeaux*, 1918, **12**, 352. (*Arch. d'électric. méd.*, 1919, **27**, 28.)

Cutaneous sensibility, painful when the faradic current is applied, is a means of clinical examination in cases of lesion of the peripheral nerves.

It has, nevertheless, been relatively little used. The author used a movable coil. The indifferent electrode, consisting of a tin plate with a surface area of 100 sq. cm., and covered with absorbent cotton wool, is placed on the nape of the neck or on the sacral region. The other electrode (Duchesne's brush) is passed over the region to be examined. It is absolutely necessary that the skin of the patient should be very dry. This can be effected by sprinkling with powdered mica, or better by washing with ether. The sensation should be one of marked heat, and to obtain this the brush should be applied vertically to the cutaneous surface, and light pressure maintained for three or four seconds. Examination of a healthy limb enables one to establish the beginning of painful sensation. The authors submit the following conclusions consequent on their researches:

(1) In all lesions of cutaneous nerves there is always disorder of sensibility, painful to the touch of the faradic brush.

(2) The degree of hypaesthesia generally appears to be related to the intensity of the lesion.

(3) The cutaneous territory of a damaged nerve is almost perfectly defined.

(4) This means of investigation reveals lesions often unperceived by ordinary examination. S. L.-B.

# MEDICAL SCIENCE

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# REVIEWS

## DISEASES OF THE RESPIRATORY SYSTEM

Jarisch records a case of **congenital absence of the lung** in a soldier, aged 29, who had taken part in the offensive in East Galicia in 1915, and died some years later of influenzal pneumonia. The necropsy showed a complete absence of the left lung, its vessels and the branch of the vagus, and only a small portion of the left bronchus was present. The left side of the chest was filled by the well-formed heart, the right lung, a projection from which formed a second apex, and fatty tissue. The right lung, showed only a slight degree of emphysema, its enlargement being due to increased formation of lung tissue. There was only a faint indication of the fissure between the middle and lower lobe. Of 9 other cases of agenesis of the lung collected by Jarisch 3 occurred in infants born dead, 1 in an infant aged six weeks, 2 in infants aged seven months, and 3 at the age of 24 years. In 4 of these the right lung was absent and in 5 the left. Only a few showed other malformations, such as defect of the septum ventriculorum, atresia ani, &c.

According to Scheppegrell **hay-fever** is relatively common in children, but the attacks are usually mistaken for 'colds'. In a series of 707 cases he found that 5 per cent. of hay-fever cases developed before the age of 10 years, and 24 per cent. before the age of 20. A low relative immunity to hay-fever pollen is undoubtedly inherited, as 37 per cent. of the writer's cases had relations of the first degree who suffered from the disease. The direct application of certain flavours to children's nostrils should not be permitted, especially in families with a hereditary predisposition to hay-fever. Any condition which impairs the normal respiratory passages in children, especially adenoids and enlarged tonsils, lowers their resistance and makes them more susceptible to hay-fever. As in adults asthma is sometimes the predominant symptom of hay-fever in children. Whenever the asthma is pronounced during the hay-fever season, the reaction to pollen is probable. The diagnosis is made by injecting into the skin 5 units of the pollen extract representing the pollen to which the child has been exposed, and the subsequent reaction determines the nature and degree of the patient's sensitization and forms the basis of the immunizing treatment. The dosage of the pollen extract for children is based on the usual ratio for their age. In acute attacks in which there is evidence of a catarrhal complication the autogenous vaccine, or when this is not available, the mixed catarrhal vaccine, is substituted for the pollen extract. When the acute symptoms subside, treatment with the pollen extract is resumed. Less than 15 per cent. of Scheppegrell's cases so treated failed to show a seasonal cure or marked improvement.

Hoke reports a fatal case of **bronchial asthma** in a man, aged 39, who died during an attack. The other remarkable features of the case were the relatively short duration of the disease (three months), the absence of any nervous factor, and the inexplicable failure of adrenalin and atropine to relieve the symptoms, though at first they had been so successful. Apart from acute pulmonary oedema the autopsy revealed nothing to account for death.

Under the name of **arachidic bronchitis** Chevalier Jackson and Spencer describe a special form of bronchitis due to the aspiration of pea-nut kernels into the lower air-passages. All the instances which they have seen have been in children, and the younger the child the more severe has been the reaction. The pathological condition consists of an oedematous, purulent laryngo-tracheitis which, if not fatal, results in lung abscess. The symptoms are due to (*a*) the swelling of the air-passages resulting in dyspnoea and cyanosis, and (*b*) the accumulation of purulent lung secretions and the absorption of toxins therefrom which results in fever and other signs of toxaemia. The condition is differentiated from laryngeal diphtheria by the fact that the patient rarely loses his voice and by the presence of well marked bronchitis, and from influenzal laryngo-tracheo-bronchitis by the history of the onset. The prognosis is grave if the pea-nut is not removed. The younger children succumb rapidly to exhaustion and toxaemia. If the pea-nut is promptly removed convalescence is usually rapid. Treatment consists in early bronchoscopic removal of the pea-nut in cases in which there is only slight dyspnoea, but when dyspnoea is well marked tracheotomy is required.

According to Jean the symptoms of **suppuration of the hilus glands** may be divided into two groups, the first being due to the presence of the inflamed glands, and the second to compression of the pedicle of the lung. At first the symptoms are indefinite; there are more or less intense dyspnoea, dry paroxysmal cough and pain in the chest. On auscultation the signs predominate in the infraspinous fossa and corresponding scapulo-vertebral space. Sometimes bronchial breathing due to compression of a bronchus is heard. At the base there are almost always subcrepitant râles, probably due to stasis of the blood from compression of the pulmonary veins. Another almost constant, but not pathognomonic, sign is bronchophony in the scapulo-vertebral space below the fifth rib with normal resonance above and below this zone. The evolution of suppurative adenitis of the hilus glands is accompanied by constitutional disturbance, fever and polymorphonuclear leucocytosis. The condition remains obscure until the pus opens into a bronchus. The presence of a vomica is shown by aggravation of the symptoms, and then, after violent cough or dyspnoea, the patient expectorates pus which is usually foetid and often mixed with blood. Improvement then occurs and recovery takes place in a few weeks. The diagnosis is usually made by radioscopy which shows opaque masses invading the transparent lung tissue in the region of the hilus.

**Gas poisoning.** In an article on pulmonary abscesses in soldiers poisoned by mustard gas, Clerc, Ramond, and Guilhaume (1) state that among 75 cases with severe broncho-pneumonia out of a total of 657 gassed patients seven developed pulmonary abscesses. All the patients were young soldiers, and, with the exception of two cases who had been subject to bronchitis, none had any previous history of respiratory disorder. The hypothesis of a superadded influenzal infection could be excluded in each case. The topography of the lesions varied considerably; the multiple abscesses were distributed throughout both lungs, while large circumscribed abscesses were usually more peripheral than central, and more frequent in the neighbourhood of the apex or base than in the middle part of the lung. The superficial situation of the abscesses accounted for the frequency of pleurisy which rapidly gave rise to dense adhesions. Bacteriological examination of the pus showed a pure culture of streptococci in one case, and of three others two yielded a culture of streptococci associated in one case with a diphtheroid bacillus, and the third showed *B. coli.* These results indicate that mustard gas is merely a predisposing cause of the pulmonary abscesses which are produced by secondary infection. In only two cases did the abscesses occur early, being found *post mortem* after 15–18 days' illness. In the others they did not develop till from three weeks to four or even six months after gassing. Although the diagnosis is difficult, the possibility of pulmonary abscess should always be considered when a gassed patient shows one or more febrile periods with symptoms of general infection and areas of subcrepitant râles. Radioscopy and exploratory puncture are the best means of diagnosis, and are the only guide to operation by which the patient's life may be saved provided the collection of pus is circumscribed, as all treatment is ineffective in the case of multiple abscesses. In some instances the presence of abscesses is revealed by the formation of vomicae which are followed by the development of extensive pulmonary sclerosis.

Clerc, Ramond, and Guilhaume (2) discuss the pulmonary sequels of mustard gas poisoning in a paper based on 441 cases, 162 of whom presented more or less permanent lung disorders, which are classified as follows: 1. *Simple relapsing bronchitis*, which was noted in 27 cases. The duration of an acute attack did not exceed 8 days, but the frequency of relapses tended to make the patient an invalid. In 1 case the symptoms had been in existence for 20 months, in 3 for more than a year, in 8 more than 6 months, and in the rest from 2–4 months. The average stay in hospital was a month and a half. 2. *Bronchitis complicated by emphysema* and dyspnoeic attacks resembling asthma was found in 31 cases. In 10 the trouble had been present for more than a year, in 11 more than 6 months, and in 10 more than 2 months. 3. *Relapsing oedematous congestion* occurred in 21 cases. It was generally found in those who had received extensive burns, or in convalescents from some pulmonary complications. In such cases the temperature, which has been normal for one or more weeks, suddenly rises to 100·4 or 102·2, and there is a return of dyspnoea with profuse, frothy, and occasionally blood-stained sputum. On auscultation oedematous râles are heard at one or both bases, and sometimes throughout the chest. As a rule the attack does not last more than 5–8 days, but at the end of one or more weeks there is a return of the symptoms, so that there may be 4 or 5 or even as many as 12 relapses during 5 months' stay in hospital. Very frequently this condition is the prodromal stage of 4, *Pulmonary abscesses* which the writers dealt with in their previous article. 5. *A pseudo-tuberculous type* was seen in 17 cases. It was characterized by loss of flesh, a sub-febrile state lasting for weeks and even months, with bronchitis, and subcrepitant râles occasionally most marked at the apices where impairment of resonance was frequently found. The stay in hospital was fairly long—on the average 4–5 months. The diagnosis and prognosis might remain obscure for a long time, but the lesions never showed a progressive character, and tubercle bacilli were never found in the sputum. 6. True *pulmonary tuberculosis* was extremely rare, being found in only 2 cases, in one of which there was a previous history of loss of flesh and slight haemoptysis.

The gross and microscopical lesions produced by the inhalation of mustard gas is described by Covey and Barron in a paper based on 37 cases, 35 of which, as stated on the field medical cards, were due to mustard gas, 1 to mustard gas and phosgene, and 1 to phosgene alone. The respiratory tract is attacked from the tip of the epiglottis to the terminal bronchioles and air vesicles. The effects are due (1) to the intense irritative and escharotic action of the gas, and (2) to secondary infection which promptly occurs. More or less of the entire mucosa is covered by a fibrino-purulent exudate, very similar both grossly and microscopically to that usually seen in diphtheria. When the membrane is removed a deeply injected haemorrhagic surface is revealed usually showing shallow ulceration. The lungs as a rule are very voluminous owing to emphysema, which is largely vesicular but occasionally interstitial or bullous. Pleurisy may or may not be found according to the extent of secondary infection present. The cut surface is characteristic. In very early or very mild cases there may be only congestion, haemorrhages and oedema surrounding the bronchial tree with emphysema of the peripheral portions, but usually the exudate in the trachea and bronchi extends down to the finest radicles, and areas of consolidation are found. In the more advanced cases necrosis is frequently present in the consolidated areas, especially near the hilus where the pneumonic areas are larger. The histological picture varies according to the rapidity of death after the injury, and consequently on the dose and concentration of the inspired gas. In rapid cases the prominent features are oedema, profound injection of the blood-vessels and haemorrhage. In the older cases, which die of secondary infection rather than from the direct effects of the gas, there is a picture of broncho-pneumonia which differs, however, from the ordinary types of organization pneumonias in that the areas of necrosis and the abscesses are more common. Attempts at healing are shown by the organization and fibrosis.

**Emphysema and wind instruments.** The question whether the playing of wind instruments for many years leads to permanent changes in the lungs has not yet been definitely settled. In a number of text-books and monographs it is stated that the practice leads to pulmonary emphysema (Laennec, Rokitansky, Mendelssohn, Ziemssen, Strümpell, Tenderloo, Herxheimer, &c.). Statements of this kind, however, are often merely the outcome of theoretical considerations or conclusions drawn from pathological observations. The first to investigate the question from the clinical standpoint was Fischer, who examined military bandsmen of various ages, and did not find an unusually high percentage of emphysema among them. Pretin and Leibkind came to similar results on examination of glass-blowers. Jagić and Lipiner, from whose article the foregoing information is taken, selected for examination 46 professional players of wind instruments belonging to the chief theatres or concert orchestras in Vienna, all of whom enjoyed a good social and financial position, so as to exclude such factors as a tobacco-laden atmosphere, alcoholic excess, and bronchitis. The period during which these musicians had exercised their profession varied from 10 to over 50 years, and the time of playing daily from 4 to 5 hours. Their ages ranged from 25 to 68. The investigation was conducted as follows: a careful history of each case was taken, and a physical examination of the thorax and lungs was made, followed by X-ray examination of the lungs and diaphragm during ordinary and deep breathing, including observations of breathing especially of the diaphragm during playing. In 39 cases the lungs and movements of the diaphragm were normal. Radioscopy showed that there was no obstruction to respiration as occurs in the development of emphysema. On the contrary all the players showed remarkably free excursions of the diaphragm, and especially a high rise of the diaphragm on expiration. In only three cases were there signs of slight pulmonary emphysema, but all the players showed signs of a relatively early rigidity of the thorax, and the slight degree of emphysema present was attributable to other factors such as a rigid thorax and constitutional bronchial spasm, and not to playing of wind instruments.

The comparative incidence of **pneumokoniosis** in man and horse was investigated by Rivers who, from the study of the literature, personal inquiry and observation in coal and ganister mines, found that horses are much less liable to pneumokoniosis than man is. He considers that the exclusive nasal breathing of these animals is responsible for this as well as for the fact that horses are much less prone than man to tubercle, especially pulmonary tubercle.

In his thesis on **gangrene of the lung in aortic aneurysm** Garbowski has collected eight cases and comes to the following conclusions: (1) Contrary to statements in text-books in which it is regarded as rare, pulmonary gangrene is a relatively frequent complication of aortic aneurysm. (2) The principal predisposing causes are (*a*) disturbance of the blood-supply of the lung due to compression of its pedicle; (*b*) various changes in the pneumogastric produced by the aneurysm. (3) The determining causes are micro-organisms derived (*a*) from a suppurating lesion in the neighbourhood such as bronchial ulceration or stagnating sputum, (*b*) from a distant lesion (embolus), (*c*) from the outer air. (4) As a rule the aneurysm is latent, although it has been in existence for some time. (5) The pulmonary gangrene masks the aortic aneurysm which is only discovered at the autopsy.

Erdman and Ostendorf report a case of **hypertrophic pulmonary osteo-arthropathy** following a lung abscess in a man aged 24. A remarkable feature of the case was that a skiagram of the skull showed an abnormally small sella turcica, so that there was probably some change in the hypophysis. The writers suggest that their patient, like the first case reported by Marie, might later develop into an irregular type of acromegaly.

**Massive collapse of the lung** as a result of gunshot wounds of the chest is described by Bradford, who states that it may be the result of a small wound limited absolutely to the chest wall. Moreover it not unfrequently occurs on the side of the chest opposite to that injured, even when the wound is slight, and the collapse involves the entire lung, so that injury of the lung itself is not necessary for its production. The collapse always occurs early, even in less than 24 hours after infliction of the wound. There may be no expectoration at any stage in its evolution and sometimes no urgent symptoms. When massive collapse is present, the chest on the affected side is immobile. Bradford is inclined to regard the collapse as due to the immobility and retraction of the chest wall and diaphragm rather than to bronchial obstruction. The mechanism by which this condition of the chest wall is produced is obscure, but possibly it is of reflex nervous origin. Certain complications may supervene in the portion of the lung affected with massive collapse such as bronchitis, pleurisy and pneumonia.

A probable case of **gonococcus pneumonia** is reported by Ross. The patient was a girl aged 16 suffering from an acute exacerbation of an old gonorrhoeal infection superimposed upon a dysmenorrhoea. Lobar pneumonia developed and followed an atypical course. The sputum was scanty and milky white with no trace of blood in it at any time. Pure cultures of Gram-negative, biscuit-shaped diplococci were obtained from the sputum, the blood, and the lung. *Post mortem*, the lungs were found riddled with minute abscesses, there was consolidation of the upper left lobe: in the lower lobe of the right lung was a large abscess and a smaller abscess in the right upper lobe. The occurrence of gonococcus septicaemia in this case is attributed to the presence of dysmenorrhoea with the damming up of the menstrual flow. In spite of the relative frequency of gonococcus septicaemia with metastases Ross could find only one other case on record of gonococcus pneumonia which was reported by von der Brissel in *München. med. Wchnschr.*, 1903. The patient, a man aged 32, while under treatment for gonorrhoea developed signs of lobar pneumonia with scanty, milky-white bloodless sputum. Pure cultures of Gram-negative diplococci were obtained from the blood and sputum. In a week's time the temperature fell by lysis, and complete resolution took place on the eighteenth day.

In an article on **pulmonary syphilis in the adult** Kayser states that the condition is much more frequent than has hitherto been supposed. The clinical symptoms consist of cough, expectoration which may be slightly blood-stained, night sweats, loss of flesh and weakness. There is, however, little or no rise of temperature. Unlike tuberculosis the apices are usually unaffected, the disease chiefly involving the middle parts of the lungs and frequently being confined to the right middle lobe, although occasionally the left lung and even the apices may be also affected. The characteristic X-ray picture consists of an intense band-shaped shadow directed upwards with its base towards the hilum (vide *Medical Supplement* 1919, **2**, 442 *a*).

Rössle has drawn attention to the frequency of interstitial syphilitic pneumonia with indurative peribronchitis in contrast with the comparative rarity of the gummatous and cavernous form.

The diagnosis can be established with fair certainty by the history and other signs of syphilis, the characteristic physical signs, the subacute or chronic course, the absence of tubercle bacilli, positive Wassermann reaction, characteristic X-ray picture, and the success of specific treatment.

The clinical diagnosis of **hydatid disease of the lung** is always difficult. There is no syndrome pathognomonic of the condition and the symptoms, which are almost always very scanty, often vary in relation to the stages of the lesion and are in no way characteristic but are common to other diseases of the lung. Eosinophilia is not pathognomonic, being found in other conditions, is not constant and often does not appear till late; deviation of the complement is absent in some cases or does not occur until after puncture of the cysts or after operation, and the diagnosis can only be established by detection of the characteristic hooklets or later by membranes, a very rare occurrence, and only found after rupture of the cysts. Fagiuoli reports a case illustrative of all these points in a soldier aged 22. The cough, blood-stained sputum, and evening pyrexia at first suggested tuberculosis, but the X-rays showed the presence of three large cysts in the right side of the chest, two being situated in the lung substance and one in the posterior pleural sinus. Deviation of the complement and eosinophilia were present though at first both were negative. Operation was refused.

Boehme Jr. records a fatal case of **aspiration pneumonia** in an infant aged 15 months caused by the ingestion and inhalation of a usually innocuous substance, a pre-existing mild bronchitis being converted into acute broncho-pneumonia with acute oedema owing to the aspiration of zinc stearate powder.

**Accidents following thoracentesis.** Tricoire reports a case of syncope and acute oedema of the lung occurring at the onset of thoracentesis which was performed for left pneumo-haemothorax caused by a penetrating wound. The symptoms were regarded as being of reflex origin, as they occurred at the commencement of the operation when only 2 or 3 c.c. of fluid had been withdrawn, and the effusion was scanty and aseptic. A similar mechanism accounts for the cases of oedema observed by Flack (pulmonary oedema following ingestion of an iced drink), by Jaccoud (oedema in typhoid fever with irritation of the abdominal sympathetic), by Vinay (oedema due to irritation of uterine sensory nerve fibres), and by Pinaut and Joucla (oedema in the course of puncture for ascites with irritation of the sensory fibres of the peritoneum).

Stähelin can find only one other case on record (Metzlar, *Nederl. Tijdschr. v. Geneesk.*, 1915, **51**.) similar to the following. A woman, aged 74, was admitted to hospital on the fifteenth day of an attack of influenza. Here moist adventitious sounds were heard over both lungs, and a moderate degree of dullness was demonstrable over the lower lobe of the right lung. Next day, as the general condition was worse and the dullness over the right lung had become more marked, an exploratory puncture was made in the 8th space, 1½ finger-breadths within the scapular line. No fluid being found, another puncture was made, this time in the 7th space, 2 finger-breadths to the right of the angle of the scapula. About 1½ c.c. of turbid and much blood-stained fluid was withdrawn. The patient, who had apparently been propped up for this operation, now lay down, She became very restless and anxious, and struggled to get up again. Respiration, which had previously been quiet, suddenly assumed a rattling character. suggestive of the onset of pulmonary oedema. After a few slight twitching movements of the body and a few forced respiratory efforts, she was dead. The diameter of the first needle inserted was 1¼ m.m., that of the second 2½ m.m. Both needles had been passed vertically into the chest to a depth of 7 to 8 cm. Suffocation due to acute pulmonary oedema was diagnosed. The post-mortem examination showed lobular pneumonia of the lower lobe of the right lung, emphysema, calcification and induration of both apices, pulmonary sclerosis, bilateral fibrous pleurisy with extensive pleural adhesion on both sides, brown atrophy of the heart and liver, atrophy of the spleen, and hyperaemia of the brain and meninges. From the larynx to the ramifications of the bronchi there was a large, sausage-shaped, elastic clot of blood, and the lower lobe of the right lung was suffused with blood. On section and microscopic examination, a wound was found in the lung corresponding to the track of the needle, and communicating with a bronchiole. No other source of the haemorrhage could be found, though a thorough examination was made of the digestive as well as of the respiratory tract. Nor was there any sign of abscess or infarct to account for the haemorrhage. The factors which, in the writer's opinion, contributed to this accident, were the patient's age (Metzlar's patient was also an old woman), the patient's general weakness which prevented her coughing up the blood obstructing respiration, the emphysema and sclerosis which reduced the normal elasticity of the lung and its blood-vessels, the extensive pleural adhesions, and the (presumptive) diminution of the coagulability of the blood caused by the influenzal pneumonia.

The phenomenon of serous sputum apart from thoracentesis is so rare that Korach proposes limiting the term 'Expectoration séroalbumineuse' to cases in which, during and after puncture of a pleural effusion, serous or purulent albuminous fluid is coughed up, presenting essential chemical and other physical differences from the fluid in the pleural cavity. Although this condition was much discussed as early as the middle of last century, its pathology is still in dispute. The writer discusses at much length the two chief hypotheses concerning the origin of the sputum in these cases, and he refuses to accept the explanation, given by Waldvogel and others, that the sputum comes directly from the fluid in the pleural cavity, through a lesion of the lung. Waldvogel's case certainly showed a striking similarity in the composition of the pleural fluid and of the sputum, but in a case observed by the writer, the sputum contained 4·2 per cent. of albumin, the pleural fluid only 3·5 per cent. The specific gravity of the sputum was 1,024, that of the pleural fluid 1,020. In another case of the writer's the pleural fluid was purulent, the sputum sero-albuminous. The explanation he gives is as follows: when fluid is aspirated from the pleural cavity, the first effect is the return of the displaced heart, mediastinum and diaphragm to their original positions. Then the lung begins to re-expand, and the more this process is inhibited by pain, and checked by adhesions, the less is the entry of air into the alveoli which become obstructed by fluid escaping from the blood-vessels of the lung. The longer the compression of the lung has lasted, the greater is the loss of elasticity in these blood-vessels, the walls of which have become more permeable. The first effect of the inrush of blood and air into the lung is cough ; and if this sign of active hyperaemia of the lung is heeded, and no more pleural fluid is drawn off, the cough soon ceases and the alarming phenomenon of profuse sero-albuminous expectoration, which has proved fatal in some cases, does not occur. Since the writer observed his first case in 1879, he has aspirated the pleural cavity about 1,200 times and has only twice provoked sero-albuminous expectoration, the onset of cough during the operation having been disregarded on both occasions. A reliable preventive of this complication is the replacement of aspirated pleural fluid by gas, which ensures a comparatively slow expansion of the lung. Another precaution is to listen to the breath sounds over the lung during aspiration. As the lung begins to expand and to fill with blood, moist râles can be heard over areas where only weak and distant breath sounds had previously been audible; and the co-incidence of this change with the onset of cough is an emphatic warning against continuing the aspiration.

**Treatment.** Frank and Strouse maintain that specific therapy in hay-fever should not be undertaken in the presence of pathological conditions in the nose or accessory sinuses. Although the removal of polypi or similar operations do not cure hay-fever, such operations may be necessary if subsequent treatment is to be successful. From their own experience and that of other writers they conclude that the best results are to be obtained by early prophylactic injection of pollen extract combined with late and intensive injections of autogenous bacterial vaccines. Pollen extracts alone and bacterial extracts alone do not appear to relieve so many patients as does the combined therapy. Treatment with pollen extract should start early in the season (June or July) and should be discontinued at the height of the symptoms when bacterial vaccines should be substituted. Although injections one year did not prevent attacks the succeeding year patients receiving continued treatment from year to year showed a definite tendency to have less severe symptoms.

Walker treated 28 cases of bronchial asthma with vaccines of the bacteria to which they were sensitive; 75 per cent. were relieved of asthma and 21 per cent. were improved. He also treated with vaccines 150 non-sensitive asthmatics, of whom 40 per cent. were relieved and 20 per cent. improved. With the sensitive cases the age of onset of the asthma, the duration of the asthma, and the age of the patient when treated had little to do with the prognosis. On the other hand, in the non-sensitive cases these facts had considerable prognostic significance; the older the patient is when the asthma begins and the older he is when treatment begins, the more unfavourable the prognosis from vaccines in non-sensitive cases. The permanency of relief from vaccines in non-sensitive cases depends on the individual resistance to the bacteria in question. The duration of relief therefore varies. Succeeding courses of vaccine treatment seem to relieve more promptly than the first course; when a relapse is not relieved by a second course of vaccines which previously did relieve, other bacteria should be suspected as the cause of asthma and new vaccines should be made.

Recent discouraging reports on the effects of an artificial pneumothorax on bronchiectasis are not confirmed by Unverricht, who has achieved considerable success, and who records the following cases:

(1) A governess, aged 22, had contracted pneumonia on the right side three years earlier. Since then there had been sputum which was occasionally foetid. Turpentine inhalation and creosote pills proved futile, and owing to the smell of her breath she had to give up her work. There were râles over the right lower lobe, and the purulent sputum, which amounted to 100 c.c., settled in layers and contained 0·05 per cent. of albumin. It did not contain tubercle bacilli. The X-rays showed band-like shadows passing from the hilus to the lower lobe. After an artificial pneumothorax had been maintained for four months, there was no more sputum or smell, and the X-ray shadows had cleared up. Recovery was found to be maintained eight months later.

(2) A man, aged 43, had contracted bronchial catarrh two and a half years earlier. Since then there had been sputum, which amounted to 150 c.c. and was sometimes foetid. It contained 0·06 per cent. of albumin, but no tubercle bacilli or elastic fibres. The X-rays showed coarse mottling of the left lower lobe. After an artificial pneumothorax had been maintained for five months, the sputum was reduced to 10 c.c., and when the patient was examined ten months later, there were still only 10 c.c. of sputum, and no adventitious sounds were audible over the lungs.

(3) A patient had suffered from bronchiectasis of the left lower lobe and hilus since pneumonia was contracted four years earlier. Haemoptysis had occurred twice; and the sputum, which amounted to 150–180 c.c., was foetid. It contained no elastic fibres or tubercle bacilli. After an artificial pneumothorax had been maintained for four months the sputum was reduced to 90–110 c.c. and was less foetid. As there seemed to be no prospect of a further reduction of the sputum, the treatment was discontinued.

(4) A woman, aged 27, had contracted pleuro-pneumonia of the right

lower lobe eight years earlier. Bronchiectasis supervened, and the sputum amounted to 120–130 c.c. It contained 0·065 per cent. of albumin, but no elastic fibres or tubercle bacilli. Quincke's postural treatment, sudorific treatment and inhalations proved futile, whereas an artificial pneumothorax, maintained for six months, reduced the sputum to 90 c.c.

(5) A man, aged 32, developed pneumonia on active service, and this was followed by bronchiectasis of the right middle lobe. The sputum amounted to 110–120 c.c., and contained no tubercle bacilli. Medicinal and climatic treatment proved futile, but an artificial pneumothorax, though it could not be maintained for more than three and a half months, banished the sputum altogether. The writer attaches much importance to adopting pneumothorax treatment at as early a stage of bronchiectasis as possible.

Rist records a case of bronchiectasis associated with pulmonary sclerosis completely cured by artificial pneumothorax. The patient had the pneumothorax performed at the age of six years, two years after the onset of the disease, and was found to be in good health five years later. Commenting on this case Émile-Weil (1) stated that he had twice performed artificial pneumothorax for dilatation of the bronchi. The first case was a soldier, aged 19, who developed bronchiectasis after broncho-pneumonia in infancy. Considerable improvement resulted from pneumothorax which was maintained for three months, but as the condition had been in existence for at least 18 years a complete cure was not obtained. In the second case which also occurred in a soldier, aged 30, whose bronchial dilatation dated from infancy, it was impossible to obtain a separation of the pleura and the treatment could not be carried out.

Brüning deprecates the treatment of pulmonary abscess by artificial pneumothorax recommended by Bergmann who had reported five cases so treated, three of which were cured, one improved, and one died. If employed at all, it should be reserved for small abscesses in a favourable situation in which there are no adhesions or any likelihood of a perforation into the pleural cavity. Such cases, however, are just the ones which clear up spontaneously. If improvement and recovery do not rapidly set in after artificial pneumothorax, the treatment should not be continued, as it is possible that a sequestrum prevents healing or that the abscess is too large to be cured by this method, as occurred in one of Bergmann's cases. Brüning concludes that the only rational treatment for pulmonary abscess is evacuation by operation.

Treatment of gangrene of the lung by artificial pneumothorax has been carried out by Émile-Weil (2) in five cases with encouraging results. The injection causes compression of the affected lung, the contents of the gangrenous focus are expelled, and its walls brought into apposition so that clinical and anatomical recovery rapidly ensues, certain precautions are necessary in carrying out the treatment. In the first place the operation is not suited for secondary or embolic gangrene. In such cases the primary focus is unaffected, and the pulmonary lesions being multiple respond less readily to treatment. Secondly, pneumothorax should not be performed on gangrene complicated by secondary involvement of the serous membranes. The only form of gangrene which is really amenable to this treatment is that in which there is a cavity, complete recovery taking place in less than a fortnight after its evacuation. The operation should always be accompanied by radioscopy.

Gross who had previously reported six cases of pulmonary gangrene treated by salvarsan, three of which were completely cured and two showed moderate improvement, has since cured three other cases by intravenous injections of neosalvarsan, as was shown by clinical and X-ray examination.

Autoserotherapy in pleural effusion was first employed in 1894 by Gilbert of Geneva to whom it had been suggested by the work of Debove and Remond on tuberculous peritonitis. The method gave rise to a lively discussion owing to the difference in the results obtained. Thus while Gilbert, Bourget, Scarpa, and Fede were enthusiastic, Landolfi and Carlotti were sceptical, and Rossi and Gamberini, Tagliamuro and Mauro denied that it had any value. Some have found that the method is most successful in tuberculous pleurisy and others in rheumatic pleurisy.

Various explanations have been given of its action, such as diminution of pleural tension caused by removal of the fluid (Lepticus), the simple consequence of exploratory puncture (Levy, Dieulafoy), introduction into the circulation of antitoxic and antibacterial products (Maragliano, Scarpa, Fede), a process of vaccination (Sarcuelli), the production of polyuria (Audibert) or an active phagocytosis. Mello now reports five cases of pleurisy with effusion which, with one exception—a case of carcinoma—were cured by autoserotherapy. The technique was as follows: an exploratory puncture was made in the posterior axillary line, a certain quantity of fluid was aspirated, the needle withdrawn slowly, and when it was in the subcutaneous tissue the whole or part of the fluid was re-injected. The amount injected varied according to the cases from 5–10 c.c., and never more than three injections were given with intervals of three or four days between each. Without drawing conclusions from so small a number of cases Mello considers that when immediate removal of the fluid is not imperative autoserotherapy should always be employed in preference to any other method, both on account of the simplicity of the procedure and its absolute harmlessness.

Émile-Weil (3) recommends that every case of sero-fibrinous effusion should be treated not only by aspiration but also by injection of air, on the ground that it is exceptional for sero-fibrinous pleurisy to be completely cured whether aspiration be performed or not. More or less marked residues persist, it being the rule for sero-fibrinous pleurisy to be followed by costo-pleuro-diaphragmatic adhesions which are manifested clinically by dullness, diminution of vocal fremitus and weakness of breath sounds at the base. Of 86 cases of sero-fibrinous pleurisy which were merely aspirated and not injected with air, 72 or 84 per cent. showed well-marked sequelae some months or weeks later, and only 14 or 16 per cent. made a more or less complete recovery. On the other hand, after injection of air 41 out of 50 cases, or 82 per cent., recovered without sequels, and only 9, or 18 per cent., had adhesions, but none of these 9 cases came under treatment until their pleurisy had been in existence some time. 17 of the 50 cases, or 30 per cent., recovered after a single injection of air in a time ranging from 2–3 months. Two-thirds of the cases required two or more injections. The only cases in which the injection did not effect a cure were those in which miliary tuberculosis of the lung, peritoneum, and meninges developed at the same time as the pleurisy. There were two further reasons in favour of the method: (1) when the lung shows active tuberculous lesions in the course of the pleurisy the injection of air may cause their retrogression or arrest, (2) in cases where a localized mediastinal pleurisy is present, the mediastinal lesion can be diagnosed by X-rays and evacuated. The technique is simple. A Potain's instrument is required together with a manometer to determine the pressure of the effusion and of the injection of air. The injection should be stopped when the pressure is the same as it was at the commencement of the evacuation of the fluid. The operation should always be controlled by radioscopy.

In a note on the medical treatment of empyema Émile-Weil and Loiseleur report 13 cases, six of which were cured without operation by repeated aspiration followed by injection of air and methylene blue twice a week. The writers attribute their success less to the methylene blue than to the air injected, but consider that the association of the two methods increases their efficacy. In seven of the 13 cases surgical treatment had to be carried out later, but no harm resulted from the delay. The symptoms which indicate continuance of medical treatment of empyema are (1) Slowness in the re-accumulation of the pus and its diminution in quantity with successive punctures. (2) Improvement in the patient's general condition and increase in weight.

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## CARDIO-VASCULAR DISEASES

Lenoble, of the civilian hospital at Brest, states that **congenital diseases of the heart** like congenital diseases of the nervous system appear to be frequent in Brittany, as in less than three years he has seen 13 cases. He records five cases in adults aged 33, 35, 38, 48, and 54 respectively, two of which were examples of mitral stenosis, while in the three others the exact localization of the cardiac lesion was not determined. In none of the patients was the general condition affected, and there were no symptoms such as pain, dyspnoea, or vaso-motor changes to direct attention to the cardiac condition. The patients, however, were in a state of diminished resistance, which accounted for their liability to tuberculosis, evidence of which was present in two of the five cases. Lenoble remarks that various forms of congenital heart disease may be distinguished. In some an acute affection has been localized in the heart during intrauterine life giving rise to a trivial lesion which, as in the cases which he has recorded, is compatible with a long and laborious existence. In other cases a general infection has interfered with the development of the organism and been the cause of developmental defects of the nervous or circulatory system including the origin of the large vessels. In such cases the possibility of cardiac complications superimposed upon congenital debility is a constant menace to the life of the patient.

Gandy reports a case of congenital incompetence of the pulmonary valves and mitral stenosis associated with tuberculosis of the left apex in a man aged 28, in whom the symptoms first appeared at the age of 19 after a violent blow in the praecordial region. In spite of the history Gandy thinks that a traumatic origin of the cardiac condition can be excluded. The rarity of the association of pulmonary insufficiency and mitral stenosis is shown by the fact that Gandy could find only one other case on record, reported by Barié. In that case, however, the double lesion was the result of rheumatic endocarditis, whereas in the present case there was no history of any infectious disease which could have affected the endocardium.

In an article on subvalvular aortic stenosis, of which they report a case, Jagić and Schlagenhaufer state that this condition was first described by Norman Chevers in the Guy's Hospital Reports in 1842, and was given the names of ventriculo-aortic or subaortic stenosis by Vulpian in 1868. A number of other cases have been described by French writers such as Lionville, Duflocque, Boinet, Weber and Degocy, Barrault, and Bret and Blanc-Perducet whose paper appeared in the *Lyon médical* in 1912. Otherwise, apart from one described by Pal (*Wien. med. Presse,* 1907), the writers have been unable to find the record of any case. The article by Thursfield and Scott, which is not mentioned by them, contains the report of a case in a boy aged 14, and a number of other examples of subaortic stenosis recorded by British authors.

The signs presented by Jagić and Schlagenhaufer's own patient, a man aged 43, were a systolic thrill at the apex, where a loud systolic murmur was audible as well as in the aortic region. Shortly before death a systolic thrill was felt in the aortic region, most marked in the second right intercostal space close to the sternum. The clinical diagnosis during life was recrudescent septic endocarditis of the mitral valve with recent aortic endocarditis. The necropsy showed two distinct processes: (1) a recent infection of the aortic valves by a bacillus whose nature was not determined, (2) a dense stenosis of the aorta situated below the valves and caused by an old endocarditic process probably of foetal origin. The mitral valve was intact; as regards the interpretation of the physical signs, the systolic thrill and systolic murmur at the apex and in the aortic region were signs of the subvalvular stenosis, while the systolic thrill over the aorta in the second right intercostal space was due to recent endocarditis of the aortic valves. In discussing the diagnosis of subvalvular aortic stenosis the writers emphasize the following signs: loud propagation of a systolic murmur downwards and to the left, the preservation of two normal sounds in the aortic area, and the thrill along the left border of the sternum at the level of the fourth to fifth ribs. Lastly, the murmur is louder in the middle of the sternum than in the second right intercostal space close to the sternum, where the murmur is best heard in valvular aortic stenosis. The absence of a diastolic murmur in the aortic region, which is almost invariable in valvular aortic stenosis, is also an important distinction.

According to Cappello the existence of **traumatic endocarditis** which was disputed by some writers (Jaccoud, Hanot) was confirmed by the experimental work of Rosenbach (1878), Wyssokowitsch (1885), Ribbert (1886), and Bonome (1886). It was found that after the injury had given rise to slight lacerations of the endocardium and subserous haemorrhages, an inflammatory reaction occurred at the site of the lesion in which micro-organisms settled and gave rise to an endocarditis which might assume an acute, chronic, or recurrent course. The condition is very uncommon as only about 20 cases are on record (the cases of traumatic rupture of the aortic valves recently recorded by French writers [vide *Medical Supplement*, 1919, **2**, 28 *b*] are not included in this list J. D. R.). Cappello relates the case of a hitherto healthy man aged 21, who, after a kick in the chest, developed signs of mitral and aortic incompetence. Infective endocarditis with multiple embolism ensued, and death took place 13 months after the injury. No post-mortem examination could be obtained.

In his paper on *abnormal, incomplete, and masked forms of aortic insufficiency and mitral stenosis* Ribierre describes the following abnormal situations for the maximum loudness of the murmur in aortic insufficiency; the region of the third *left* costal cartilage, the tip of the xiphoid cartilage, the apex of the heart, and in exceptional cases the left axilla and even the interscapulo-vertebral space. In practice, therefore, one may conclude with Laubry that any diastolic murmur in the praecordial area should be regarded as connected with aortic insufficiency. Numerous variations are also found in the direction of the propagation of the murmur. In some cases it may be conducted along the left border of the sternum instead of down the right border. In others it is directed obliquely towards the apex, and in a third group it passes almost at right angles across the body of the sternum towards the second or third left intercostal space. Sometimes the murmur is limited to a point more or less distant from the base of the heart, e. g., just above the xiphoid cartilage or more rarely at the apex of the heart. Lastly, limitation of the duration of the murmur is far from rare, the murmur being often limited to the first part of diastole.

The existence of aortic insufficiency without a murmur which was first described by Gairdner in 1872, and then by Furbringer in 1878 has since given rise to numerous publications. Judging from the number of cases on record, instances of this kind are not exceptional, and their frequency is probably underestimated as numerous cases escape detection owing to incomplete examination. It does not appear that the age or sex of the patient or the cause of the aortic disease is responsible for the absence or disappearance of the diastolic murmur. No adequate explanation is furnished by anatomical considerations, and it seems best to follow Bard who classifies cases of aortic incompetence without a murmur according to the following conditions in which they are found, viz., (1) cardiac failure. (2) Complete arrhythmia. (3) Co-existence of multiple cardiac murmurs in which one lesion masks the others. (4) Period of formation of the aortic lesion. According to Bard the diastolic murmur is most frequently absent at the onset of aortic insufficiency of arterial origin in which the lesion is formed by the extension of chronic aortitis. (5) Functional aortic insufficiency associated with hypertension. As a general rule the absence of a murmur is only temporary, though the murmur may be absent for a long time. In mitral stenosis the incomplete and abnormal forms are of less interest than the larval or masked forms of which there are two types which closely simulate tuberculosis and chlorosis respectively. Ribierre emphasizes the fact that the phenomena of mitral stenosis are rarely distinct before the age of 12 years, as was noted long ago by Duroziez and more recently by Poynton. The absence of the characteristic murmur of mitral stenosis may occur in failing compensation, complete arrhythmia with auricular fibrillation, and in attacks of tachycardia, when the tachycardia reduces the duration of the diastolic period.

Goodman and Cash point out that left apical dullness occurs with persistent regularity in mitral stenosis and is not met with in other cardiac disorders. This fact is all the more important as haemoptysis and shortness of breath with other signs of failing health are early symptoms in mitral stenosis, so that there may be a striking resemblance between the symptoms of pulmonary tuberculosis and mitral stenosis. The dullness characteristic of mitral stenosis is found generally anteriorly above the third rib, extending to the clavicle and sometimes above it. It extends a variable distance to the left, at times as far as the outer third of the clavicle. It is unassociated with râles as a rule, and the voice sounds are not characteristic, while the breath sounds assume a broncho-vesicular murmur at times. The writers attribute the dullness to the enlargement of the left auricle which in some cases deadens the sound waves elicited on percussion by its contact with the lung, and in others causes actual compression of the lung itself. In cases therefore in which this apical dullness is found a diagnosis of tuberculosis should be withheld until the heart has been examined for mitral stenosis.

In the great majority of cases of **aneurysm of the heart** the usual signs and symptoms of cardiac enfeeblement have been present and angina is a fairly common symptom. Wilson records a case of aneurysm of the heart in a lady aged 60 who had led an active life till the day before death when she complained of substernal pain and vomiting. The necropsy showed a ruptured aneurysm on the surface of the left ventricle: in other respects the heart appeared normal. Wilson has found only one other similar case on record, reported by Hughes, (*Lancet*, 1914, i, 533), whose patient, a dock labourer, aged 49, suddenly dropped dead, and a ruptured aneurysm was found on the anterior wall of the left ventricle *post mortem*.

According to Letulle and Hufnagel **actinomycosis of the heart** is a very rare occurrence. Only about 23 cases are on record, and half of these are examples of suppurative metastatic emboli derived from a distant actinomycotic focus. The writers report a case of actinomycosis of the oesophagus which involved the heart and lungs producing extensive lesions in the pericardium, myocardium, and endocardium. The patient was a man aged 24 whose illness had commenced three years previously with signs of pleurisy and bronchitis. Two months before admission to hospital progressive oedema had developed, and death took place from heart failure the day after admission.

**Cardiac displacement**. A case of acquired dextrocardia in a man aged 26 due to an enormous empyema of 2½ years' duration is reported by Vogt. After evacuation of the pus, 9½ litres of which were removed in the course of three days, the heart gradually returned to its normal position. Although the empyema had been in existence for so long, no signs of amyloid disease of the viscera had developed.

Binetti records a case of extreme backward displacement of the heart probably due to mediastino-pericardial adhesions following pleurisy in a soldier aged 31, the apex beat being in the eighth space between the posterior axillary fold and the scapula. In spite of this condition the patient had never complained of his heart, and even on examination only a slight diminution in its functional capacity was found.

**Bradycardia.** In the course of last winter Lorand had occasion to examine numerous soldiers and workmen in Vienna who had gone on strike on account of their inadequate food supply, and especially the diminution of the bread ration. He found that a large number of young persons aged from 20–24 years had a pulse of 56–60 beats per minute, although otherwise they showed no signs of organic disease of the heart. He also noticed that many soldiers and working people of both sexes had attacks resembling angina pectoris for which no other cause could be found but the monotonous diet which chiefly consisted of a small quantity of dry vegetables and war bread. Lorand attributes the bradycardia and anginal attacks not merely to the absence of vitamines in the food, but also to the lack of calcium, potassium, phosphorus, and sugar, which are necessary to enable the heart to contract, its work being carried on like that of all other muscles at the cost of the sugar which is present in the muscles in the form of glycogen. It is obvious therefore that if too little of these substances is present in the blood, a longer time will elapse before the heart can contract. In support of this explanation of the bradycardia described is the fact that Jansen found that the calcium and sugar content of the blood in war oedema which is caused by a diet of this kind is distinctly lowered (vide *Medical Supplement*, 1918, **1**, 392). A further confirmation of Lorand's view was furnished by the disappearance of the bradycardia in every case when a diet was supplied containing much sugar in the form of honey, and rich in calcium, potassium and phosphorus, as well as in vitamines.

In a paper on the **cardio-vascular symptoms of mustard-gas poisoning** Clerc and Rousselot come to the conclusion that the cardio-vascular system is not primarily affected by mustard gas during the acute stage; myocardial failure when it does occur is secondary to progressive asphyxia and superadded infection. Sequelae properly so-called are infrequent and ill-marked, being the result of pulmonary involvement or a state of attenuated infection which persists for a long time in subjects of mustard gas poisoning.

The condition of the **heart in coal-gas poisoning** is discussed by Zondek in a paper based on the study of 9 cases, 3 of which are recorded in detail. The following symptoms were found to be constant: (1) a pronounced fall of blood-pressure which lasted for a week. (2) An initial tachycardia succeeded on the third or fourth day by slowing of the pulse. Extra-systoles or well-marked respiratory arrhythmia were present. (3) Acute cardiac dilatation of varying degree. It usually disappeared on the third or fourth day after the poisoning, but in one case it did not develop till the third day.

**Cardiac conditions in recruits.** According to MacFarlane among 66,575 drafted men examined at Camp Gordon, Georgia, 373 were immediately discharged for marked cardio-vascular lesions. Statistics showed similarity of figures for all the states except Iowa, in which the men presented one half the physical disability of the men in other states and on the average were the best physical types of the men examined. Of the cardio-vascular lesions discovered there were 86 cases of mitral insufficiency, 24 of mitral stenosis, 26 of aortic insufficiency, 1 of aortic stenosis, 34 of myocarditis, 56 of hypertrophy with hypertension, 5 of hypertrophy without hypertension. 75 of persistent tachycardia, and 49 of irritable heart or neuro-circulatory asthenia, 1 of adhesive pericarditis, 1 of aortitis, 1 of bronchial aneurysm, and 1 of marked anaemia with anaemic heart. Two cases of dextrocardia were found, one in general examination and one was remarked because a right varicocele drew attention to the fact. The ratio was 3 cases of dextrocardia to 100.000 persons. The cases were not rejected. Cases of mitral regurgitation without hypertrophy were accepted when there was no accentuation of the second pulmonary sound. A systolic pressure of less than 150 was considered hypertrophy without hypertension. Aortic insufficiency cases usually gave a history of heavy work; syphilis was noted in 30 per cent. of these cases. with a definite diastolic basal murmur in every case; there was also marked hypertrophy of the heart.

Kahn carried out comparative **functional tests** of the circulation in 233 recruits between the ages of 20 and 30, including normal individuals, various forms of tachycardia, sinus bradycardia, thyrotoxic conditions, neuro-circulatory asthenia and various forms of heart disease. The pulse-rate, systolic and diastolic blood-pressure were taken in the seated posture and repeated with the patient standing, and again after exercise. Hopping 100 times on one foot was the exercise used. The characteristic finding in simple tachycardia. in compensated mitral regurgitation, and in sinus bradycardia was the absence of any effect upon, or only a very slight increase of the pulse-rate after exercise. In thyrotoxic heart the characteristic effects were marked instability of the pulse-rate with great increase after exercise, associated with instability of the diastolic blood-pressure. A similar but less marked effect was found in neuro-circulatory asthenia. In aortic regurgitation the systolic blood-pressure fell much more than normally when the erect position was assumed. With exercise the systolic and pulse pressure rose more than normally, but fell back suddenly to normal within one minute after the exercise.

Dana places the following criteria in order of their value as indications of a damaged myocardium: (1) The general appearance of the subject, with special reference to his colour, the occurrence of actual dyspnoea or distress or cough, or exhaustion, resulting from exercise. (2) The presence of a true gallop rhythm at rest or after exercise. (3) The production, as the result of exercise, of a relative mitral insufficiency, as evidenced by a murmur. (4) The presence, in the absence of valvular disease, of signs of decompensation such as oedema of the lungs or of the extremities, whether at rest or after exercise. (5) Weakening of the first sound at the apex, resulting from the effort test. (6) Increased strength of the first sound over the right ventricle as compared with the first sound at the apex, occurring after exercise. (7) Weakened first sound at the apex at rest in the absence of emphysema. (8) The production following the effort test of irregular heart action or the increase in irregularity already present, brought about by exertion. (9) Loss or weakening of the second sound at the apex, due to exercise. Variations in the systolic, diastolic, or pulse pressure are considered by Dana as giving relatively little information regarding the cardiac function.

According to Balard, examination of the **oculo-cardiac reflex**, which serves as a ready method for exploring the tone of the vagus and indirectly of the sympathetic, is not wholly free from risk. Lian, Petzetakis, and Loeper and Weil have described the occurrence of colic, nausea and collapse.

Balard records four cases in soldiers of stoppage of the heart from 15–20 seconds while the reflex was being investigated. He attributes the symptoms in his cases to an extraordinary excitability of the vagus and to the coexistence of epilepsy or hypothyroidism, and deprecates a systematic examination of the oculo-cardiac reflex in view of the possible dangers resulting therefrom.

Gerber of the Königsberg University Polyclinic for Diseases of the Throat and Nose describes an early symptom met with in diseases of the aorta and heart. It is principally seen in men between 45 and 55 and above, and much less frequently in women, in whom it may appear at as early an age as 30. No cases were observed in young persons. The symptoms were always confined to the throat, the patients complaining of 'an unpleasant feeling in the throat' or of dryness, burning, pricking, tickling in the throat, with a desire to cough and difficulty in swallowing. Hoarseness was never present, and inspection of the pharynx and larynx was negative. Examination of the other organs, especially by X-rays, showed that it was not the respiratory tract that was affected, but that certain abnormalities were present in the circulatory system, the aorta in most cases, and much less frequently the heart being involved. Gerber records nine cases in persons aged from 32 to 58, in seven of which the paraesthesia described was associated with aortic aneurysm in men, and in two with mitral disease in women. The occurrence of these symptoms, of which no mention is made in text-books of laryngology or general medicine, is attributed by Gerber to irritation of the sensory fibres in the recurrent laryngeal nerve, the irritation being followed at a later stage by signs of motor irritation or spasm and last of all by paralysis, which is a well-known accompaniment of aortic aneurysm.

**Disordered action of the heart.** In a report on the aetiology of disordered action of the heart based on the study of 7,803 cases which he observed during the course of two years, Venning states that the greatest factor in the production of symptoms was the physical and mental strain of war, which accounted for 19·6 per cent. in the first six months, and as large a percentage as 36·2 in the third six months. Infections came next as a cause varying very slightly in each period of six months, viz., from 20·3 per cent. to 22·4 per cent. Rheumatic fever accounted for from 40·7 per cent. to 56·7 per cent. of the total cases of infection. Pyrexia of unknown origin was the infection which produced the next highest numbers varying from 6·4 per cent. to 10·3 per cent. of the total infections. Scarlet fever, enteric, dysentery, diphtheria, and malaria caused about the same number. The number of cases due to gas increased each period of six months from 0·9 to 10·6 per cent. Lastly, in 15·7 to 27·4 per cent. the causation was unknown.

According to Neuhof infection is a factor only in so far as it induces nerve and muscular fatigue and psychasthenia. There is no pathological change in the cardio-vascular system. The aetiological factors of the irritable heart as observed in general practice, and in soldiers, are similar, but because of training and war conditions, dormant and latent neuroses are more readily evoked so that in soldiers the syndrome is more violent and lasts longer.

In a study of the aetiology of war tachycardia Gaillard (1), like Aubertin, found that the majority—20 out of 34 cases—had developed before enlistment, and only 14 after enlistment. As regards the aetiology of the first group, in the great majority of cases the symptoms had not followed immediately on any pathological incident, whereas in the second group a definite cause could be assigned in three-quarters of the cases. The reason for this difference appeared to be simply the fact that definite information was much more readily obtained as to what had happened to the patients during the war than with regard to the events of their early life. On grouping the tachycardias together irrespective of their development before and after the outbreak of war, the causes were found to be as follows: in eight cases a general infectious disease (acute articular rheumatism in four cases, enteric in two cases, malaria in one case, prolonged post-vaccinal infection in one case); left pleurisy in one case, mustard gas poisoning in two cases, and violent emotion or commotion in four cases. These various causes appeared to have no connexion with one another, so that no common aetiological factors for the condition could be found.

The same conclusion is arrived at independently by Warfield in a paper based on the study of 315 cases of irritable heart or cardio-vascular defectives, which he classifies in three groups: A. Strictly cardio-vascular. 1. Following infectious diseases, chronic myocardial degeneration. 2. Existing since childhood, (*a*) associated with poor mentality, (*b*) associated with good mentality. B. Some defect in endocrine secretion. 1. Hyperthyroidism. 2. Exophthalmic goitre. C. Associated with definite somatic lesions. 1. Pulmonary tuberculosis. 2. Hodgkin's disease. 3. Focal infections. 4. Other diseases, such as cirrhosis of the liver, asthma, &c.

In an article on tachycardia in young recruits Aubertin states that 15 recently incorporated recruits presented a tachycardia ranging from 100 to 160, but as a rule about 120, and closely resembling the condition met with in cases evacuated from the front with the diagnosis of 'soldiers' heart'. The only differences found were not important; the blood-pressure was less often raised, as was natural in young subjects who had been less exposed to toxic influences. The tachycardia was less frequently reduced by rest, but this was readily explicable by the fact that soldiers from the front were in a state of exhaustion, whereas the recruits were living under practically normal conditions. Only one patient gave a history of acute articular rheumatism, three showed signs of neurosis, and one had nasal obstruction, in the rest aetiological inquiry was completely negative. Aubertin concludes that the syndrome of tachycardia with or without hypertension or inorganic murmur may be found in persons who have not been subjected to the fatigue, emotions, and toxic influences of life at the front. The cases also show that neither rheumatism nor definite neuroses are responsible for a large number of cases, and that the aetiology of the condition is still unknown.

In a paper based on his experience of disordered action of the heart with the Mesopotamian force Gosse found that compared with cases seen in civil practice there was an increase in the tachycardias with regular rhythm, whereas the severe form of disordered action indicating serious disease were comparatively rare.

Laubry and Leconte examined the blood-pressure of all the cases of D.A.H. in Vaquez's wards during the course of four months. The examinations were made with the Laubry-Vaquez instrument and Pachon's oscillometer successively between 9 and 10 a.m. almost every day for the two or three weeks that the patients remained under observation, and were often repeated several times the same day in the vertical and recumbent position. The results were as follows: A. Variations in the blood-pressure. The patients were classified from this point of view in three groups: (1) the unstable cases, forming nearly two-thirds of those examined, whose blood-pressure varied from 2–4 cm. with the same instrument from one day to another: (2) the stable cases in which the variations did not exceed ½–1 cm. at most: (3) cases in which the blood-pressure was high on admission but gradually came down to normal, as the result of rest and diet. B. Variations in the maximum and minimum pressure. Variations in tension were almost entirely confined to the maximum pressure, it being exceptional to find the minimum vary more than 2 cm. while the maximum showed differences of 3 and 4 cm. C. Influence of position. Variations of blood-pressure with the patient's position were very irregular, and though generally the assumption of the vertical position was accompanied by a rise of maximum pressure, the rise was always very slight. Fairly often it did not occur, and sometimes there was even a slight fall. D. Relation of blood-pressure to other symptoms of cardiac instability. It was a surprising fact that variations in blood-pressure did not appear to be specially marked in cases of great instability, irregularities in the blood-pressure curve being found in the mild as well as in the severe cases.

As the result of his study of 65 cases Gay found that there was a slight leucocytosis in patients with irritable heart, but that the figures corresponded to those found in patients with organic heart disease. There was a relative lymphocytosis present in the blood of patients with irritable heart, the limits being 15 and 51 per cent. A marked leucocytosis occurred in both patients and controls after injection of epinephrin. The increase was much greater in patients with a positive reaction than in controls who did not respond to the drug. Morphological studies of the blood in cases of irritable heart did not show anything of significance that might help in the diagnosis.

In a study of irritable heart King, Jr. (1), did not find any sounds or murmurs which differed in any essential particular from the various types of murmurs occurring in healthy soldiers who have done duty, such as third heart sounds, reduplication of the first sound at the apex, cardio-respiratory systolic and diastolic murmurs, and extrasystoles. He concludes that murmurs and adventitious sounds have probably only an accidental relationship to the irritable heart of soldiers.

X-ray examination by Gaillard of the heart and aorta in 34 cases of so-called ‘war tachycardia’ showed that in about half the cases there was a relative or absolute hypertrophy of the left ventricle, while in ten instances the aorta presented an exaggeration of its curvature, and sometimes even a more or less marked widening of its calibre in old-standing cases.

In a group of 246 men studied by King, Jr. (2), with ‘irritable heart of soldiers’ one was found with definite signs of arrested pulmonary tuberculosis, and two developed active pulmonary tuberculosis after influenza, but no other cases occurred. King concludes that there is no evidence that more than an accidental relationship exists between irritable heart and pulmonary tuberculosis.

According to Murray Leslie, a large proportion of cases of D.A.H. recover more or less completely according to the degree of actual efficiency of the myocardium. A history of rheumatic fever or of frequent attacks of influenza or of a prolonged febrile disorder should make the prognosis guarded owing to the possibility of myocardial degeneration. Generally speaking, the prognosis may be said to depend on the degree of response to treatment, particularly to graduated exercises. A long continuance of tachycardia and dyspnoea with persistent praecordial hyperalgesia and continued leucocytosis is regarded by Leslie as indicating a prolonged convalescence. Many months will elapse before such a patient is able to undertake any form of work, and it may be a year or more before he can resume his ordinary duties, even when there has never been any definite indication of actual disease of the heart-muscle.

C. and L. Walker report a case of sudden detachment of the aortic intima or so-called **dissecting aneurysm**, the rarity of which is shown by the fact that in some 2,500 necropsies they had not previously met with a single case. The patient, a man aged 65, apparently in good health, fell down suddenly and nearly died. He recovered somewhat and complained of intense substernal pain and pain and paresis in the left leg. About 38 hours later he died suddenly. The necropsy showed that the aorta was extensively atheromatous and that the greater part of the aortic intima was lying free in the lumen.

**Angina pectoris and syphilis.** Josué recently performed the Wassermann reaction in six out of ten cases of angina pectoris and found that it was positive in only two. This proportion was considerably lower than that obtained in various forms of aortic lesions, such as aneurysm, aortic insufficiency and stenosis. or chronic aortitis, in which, according to Moricaud, the frequency of positive reaction ranges from 50 to 70 per. cent. Josué accordingly subjected all his ten cases of angina pectoris to specific treatment. With one exception in which, owing to the bad general condition and large amount of albuminuria the treatment had to be stopped after the fourth injection, no bad effects were observed. Of the remaining nine, one showed no improvement after eight injections, when the treatment was abandoned. In eight cases either a permanent cure was effected or the attacks were postponed and became less severe. The improvement became obvious after the sixth or seventh injection, sometimes after the fourth or fifth. Although the attacks usually disappeared entirely after the first series of injections, Josué gives a second series after a fortnight's interval, and considers it advisable to repeat the injections every three or four months to maintain the cure. As novarsenobenzol has serious drawbacks, especially its tendency to cause acute pulmonary oedema, mercury cyanide in doses of 1 cgm. every two days in a series of fifteen intravenous injections was used. Josué urges that this method should be carried out in every case of angina pectoris, even if there is no other sign of syphilis and the Wassermann reaction is negative, provided that the patient's general condition and tolerance of the drug permit it.

In a paper on **sclerosis of the coronary arteries** in Switzerland, based on necropsies performed at the Geneva Pathological Institute, Orliansky points out that arteriosclerosis begins later in Switzerland than in Germany. Whereas 40 per cent. of the cases of sclerosis of the coronary arteries in Germany are found between 18 and 20, in Switzerland only 23 per cent. are found at this age. From 21 to 30, the military age *par excellence*, the figures are practically identical for the two countries (45·8 per cent. according to Mönckeberg for Germany, and 46 per cent. for Switzerland). The war therefore has had no influence on the development of arteriosclerosis in the third decennium. After 40 years of age there is again a difference between the Swiss and German statistics. Whereas in Germany there was no instance of coronary arteries being intact after 40, at Geneva they were found to be normal in the fifth decennium in 12·8 per cent., and even in the sixth decennium in 20 per cent. Orliansky suggests that the difference between the two sets of statistics may be explained by difference in individual predisposition in the two countries. On the other hand, in a considerable proportion of the Swiss cases death was due to influenza, so that possibly there was a common factor predisposing to arteriosclerosis and severe attacks of influenza. If this hypothesis be accepted, it may be concluded that arteriosclerosis begins later in Switzerland, the apparent identity of the percentages of sclerosed coronary arteries in the two countries being the result of influenza. The question, however, can only be decided by statistics which are not affected by the war or influenza. The left coronary artery was affected sooner, more frequently and intensely than the right. The coronary arteries in women were less affected than those in men, probably owing to the nature of their occupation. Sclerosis of the coronary arteries was found at a relatively early age, viz. 17, the earliest cases of sclerosis of the aorta being 23 in the male sex and 29 in the female, and increased in frequency and intensity with age.

The study of patients suffering from *thrombo-angiitis obliterans* has convinced Meyer that it is a systemic disease and not, as Buerger believes, a primary affection of the blood-vessels. He regards only one aetiological factor as responsible for the characteristic syndrome of claudication, pains, and gangrene, viz. tobacco-smoke poisoning, the symptoms being produced by the combined action of the nicotine, pyridine, cyanic hydrogen, and carbon monoxide contained in tobacco smoke.

**Microsphygmia** is the term which was given by Variot in 1898 to a permanent but variable smallness of the pulse observed by him in idiots, and since described by Gaston and Emery, and by Richet fils and Saint-Girons. Laroche and Richard examined for this sign the inmates of an asylum consisting of 72 females aged from 4 to 70, and presenting all degrees of cerebral defect from simple mental deficiency to the most complete idiocy. Microsphygmia was found in 20 out of 39 idiots, but in only 1 out of 33 cases of mental deficiency or imbecility. Ichthyosis, which formed part of the syndrome described by Variot, was very inconstant, being present in only 30 per cent. of the cases of microsphygmia. There was an absolute lack of correspondence in the amplitude of the pulsations in the different arteries, the pulsation in the brachial being often almost normal, while the radial pulse was imperceptible. On examination of the larger trunks, such as the subclavian or carotid, the difference between the pulsations of the central and peripheral arteries was made still more distinct. The heart in the cases of microsphygmia was of normal size, and the energy of its beat on auscultation was in striking contrast with the feebleness of the pulse. As regards the pathogenesis, an anatomical change, such as arterial aplasia, could be excluded by the variable character of the sign and by the fact that a post-mortem examination of one of Variot's cases showed that the calibre of each vessel was normal. The writers attribute the condition to hypertonus of the sympathetic, due to a lesion of the upper nerve centres in early life and aggravated by functional changes in some of the glands of internal secretion.

After discussing investigations on the prognostic significance of a permanently raised blood-pressure, published by T. C. Janeway in 1913 in *Archives of Internal Medicine*, and suggesting that the conclusions were too optimistic and misleading owing to the exclusion of many fatal cases from the analysis, Topp gives his own observations. They indicate a most gloomy prognosis. In the period 1913–1916 inclusive, records of the Finsen Institute's hospital for internal diseases showed there were 164 cases in which the blood-pressure was permanently raised, being above 180 mm. In 157 of these cases the fate of the patient after discharge from hospital was ascertained. Most of, if not all, the patients were suffering from various forms of heart disease, and their blood-pressure was measured at least once a week by the same physician and with the same apparatus. In only a few cases was the disease, for which the patients were admitted to hospital, in an advanced stage. The measurements were made while they lay in bed; a broad cuff was used, and the figures recorded represented the highest systolic pressure found during residence in hospital. Within two years of the discharge of the 157 patients, 131, or 83·5 per cent., were dead. According to the tables in which the patients were classified with reference to age, sex, and height of blood-pressure, the two first factors did not appear to affect the death-rate. But this was directly proportional to the height of the blood-pressure, a pressure of 190 to 199 mm. corresponding to a death-rate of 66·6 per cent., while no patient with a pressure exceeding 260 mm. survived the two-year period. Of the patients with a pressure exceeding 220 mm., only two survived, while 38 were dead within the same period. In two-thirds of all the cases renal sclerosis was demonstrable. In the remaining third there may have been several cases of renal sclerosis not demonstrable by the usual tests. The mortality for the cases with demonstrable renal sclerosis was 84 per cent.; that for the remainder, 83·5 per cent. Of the 16 per cent. surviving the two-year period, a few were still alive five years after the detection of the raised blood-pressure; but most of these survivors were leading the sheltered life of the chronic invalid. The writer adds that, if Janeway's figures are readjusted so as to include the patients first seen shortly before death, the mortality within the two-year period is raised to 79·7 per cent.

**Treatment.** Neuhof has found that if after careful examination patients with D. A. H. could be assured they had no heart disease and that the symptoms were the result of 'upset nerves', the cure was tremendously hastened. Sudden sharp exercises should be avoided. Billiards, croquet, bowls, golf, light farming, and, in cases which are improving, rowing and even swimming in shallow water, are to be recommended. Medicinally he has found mixed bromides (1 grm. mixed with water t. d. s. p. c.) and suprarenal gland (in gr. v tablets to be taken when praecordial distress and tachycardia become annoying) the best drugs. The effect of the suprarenal preparation is only temporary, and therefore may be repeated several times a day.

Christian maintains that the physician is prone to give too small doses of **digitalis,** and usually fails to push the drug to the limit of tolerance, as should be done unless a definite effect is produced sooner. Although the brilliant effects of digitalis are seen most commonly in auricular fibrillation, Christian states that he has frequently seen just as good results in chronic cardiac cases with oedema in which there was no irregularity of the pulse or only an occasional extra-systole. He regards the powdered leaf made freshly into pills as satisfactory a form of digitalis as either the tincture or infusion, and if the leaf is good, just as effective as digipuratum or digifolin and far less expensive.

Gilbert and Khoury have found that digitalin in intravenous injection may be effective where its administration by mouth has no result. The method is of value in the cardiac failure of valvular disease and of arterial cardiopathy with or without hypertension. The intravenous injection does not seem to exercise a uniform action on the blood-pressure. In most of the cases observed the tension was not affected, in a few it was raised 1–2 cm., and in others it showed a fall of 1–3 cm. The doses employed by the writers were at first small, and did not exceed 10–15 drops a day or 35 drops in 3 or 4 days, but they were soon raised to 25 drops daily and to a total of 62 drops in 3 days or 75 drops in 4 days without any sign of intolerance being observed.

Neumayer urges that the intravenous injection of **strophanthin** should not be used as a last resort, but should be employed in disturbances of compensation of slight degree, its action being rapid and certain in early stages of cardiac insufficiency. A few injections do more good in a short time than treatment by digitalis for weeks. He has never observed any bad effects from the method. Many cases were treated as out-patients and could easily walk home afterwards. The initial dose was ½ mg., which was afterwards increased to 1 mg., half the dose being given to children. The effect was generally excellent. The patients often felt quite well after a single injection, and in such cases after 3–4 injections an interval of 3–8 days was allowed to elapse, while in others a course of 6–12 injections was given, followed by an interval of equal length.

During the last two years Robinson has adopted sublingual medication with hypodermic tablets of strophanthin as preferable to swallowing, the gastric fluids in cases of heart failure being apparently antagonistic to the stimulating effects of strophanthus. In tablet form, given sublingually, strophanthus proved as rapidly effective as when given hypodermically.

**Intracardial injection** of circulatory stimulants, as advocated by von der Velden in cases of heart failure (vide *Medical Science*, 1919, **1**, 80), is recommended by Vogt for the treatment of pale asphyxia in the newborn. An injection containing 0·5 c.c. normal saline with 8–10 drops of suprarenin, or 0·2–0·4 hypophysin, or 0·3 digipuratum is made in the fourth left intercostal space. Vogt admits that his own experience of the method has not been successful, chiefly because the injections were made too late. Some of his failures were explained by the fact that the asphyxia and consequent damage to the heart were caused by cerebral compression due to haemorrhage, as was shown *post mortem* in several cases. Although up to the present he has only succeeded in keeping the heart going for 1–2 hours, Vogt regards the method as indicated in all severe cases of white asphyxia in which the heart is working feebly and irregularly, or has even completely stopped. The injection should be given as soon as possible after clearing the respiratory passages.

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## EXTRADURAL, SUB-CRANIAL DERMOID CYSTS

**1. In the right occipito-mastoid region.** A private aged 25 was admitted from the French front to King George Hospital on December 8, 1917. For six months the man had noticed a lump to the right side of the back of his head; it had grown so that his helmet no longer fitted, and that was the sole reason why he reported it. There had been no injury, or other sign or symptom. He presented a hemispherical swelling $2\frac{1}{2}$ inches in diameter, raised about 1 inch above the outer surface of the skull, which extended backwards from the posterior margin of the right mastoid process. On palpation the periphery of the swelling yielded the sensation of a bony ring, not markedly raised above the level of the skull. Inside this ring the swelling was uniformly elastic; the scalp was normal and freely movable over the swelling; there was no pulsation or impulse on coughing; the swelling was dull to percussion.

An X-ray photograph showed a gap in the skull corresponding in diameter with the bony ring. Nothing else was made out until ten days after admission, when by a semicircular incision a flap of scalp was turned down from off the swelling. This exposed a normal occipitalis muscle with the occipital artery crossing the swelling. The artery was divided between two ligatures. Beneath the muscle the pericranium appeared unaltered. On making a crucial incision through it a quantity of inodorous sebaceous material was wiped out without starting haemorrhage. No hair or other contents was observed, and the interior of the cyst was smooth. The margin of the skull was next chipped away until an opening 2½ inches in diameter was made. It was then seen that the wall of the cyst was nowhere thicker than egg-membrane, and beneath it was the intact dura mater which had not become vascularized. The thin cyst wall was sponged off the dura mater and it was recognised that the cyst had been globular and had compressed both the hinder end of the occipital lobe and the lateral lobe of the cerebellum. Across the middle of the cup lay the lateral sinus. The patient's pulse was good, and the cupped brain showed evidence of re-expanding; the excavation was lightly plugged and some loose sutures inserted. Four days later the plug was removed and the sutures knotted. The wound appeared to heal by first intention, and he was sent to a convalescent home from which he was returned with a discharging sinus. On exploration it was found that the sinus had been occasioned by a little of the cyst wall which had been left over the lateral sinus. This remainder was destroyed by fuming nitric acid, and the cavity plugged; the dressing was continued until firm healing had resulted.

**2. In the right parieto-occipital region.** A private, aged 28, was admitted to the hospital at Angoulême under Vouzelle of Limoges with the diagnosis of an abscess in the right parietal region on June 24, 1917. In the course of September or October 1914, the man had noted for the first time a small swelling, the size and shape of a nut, in the position of the right lambdoid suture, but he gave it no further notice until about August 1916, when it had swollen, and he then had severe attacks of headache. The attacks lasted several days and recurred every two or three months. There was no precise localization of the pain, but he noted that at times he could hear nothing with the right ear, then his deafness would disappear suddenly. The swelling increased and also the severity of the attacks of headache, and there was fever. On admission there was severe headache, and almost complete deafness on that side; the scalp was tense and red over a large swelling in the right parietal region. His temperature was 39·2 C., and his pulse-rate 100.

An incision was made and a tube inserted. Much pus escaped but the patient was not relieved. Two days later, on exploration, a gap in the skull was found 6 cm. above the inion and 6–7 cm. to the right of the middle line. Through this escaped pus mixed with foul material like cooked chestnut meal. The hole in the skull was 2 cm. in diameter, at the junction of the parietal and occipital bones, just above the asterion. To expose the subcranial part of the cyst this perforation was enlarged to an ellipse 5·5 cm. by 4 cm. The wall was removed from the dura mater which appeared grey and had lost its polish. It had been separated from the skull to the depth of 2 cm., so that it had become stripped up from the petrous portion of the temporal bone as far as the posterior border of the lesser wing of the sphenoid. The abscess cavity outside the skull was curetted, and the scalp sutured except for a drain. Healing followed in eight weeks. Eighteen months later the patient was free from headache and all other trouble, except that the deafness on the right side persisted.

**3. In the occipital region.** Walther, in 1895, reported the case of a man aged 34 who, five years before, had had a cyst removed from over the occipital protuberance. A sinus had persisted which was found to communicate with a large subcranial cavity through a hole in the skull. The occipital bone was removed around the perforation so as to expose the cavity which was placed superficial to the right lobe of the cerebellum; the torcular herophili and the right lateral sinus formed a prominence in the floor of the cyst. The wall of the cyst was composed of a thin membrane without hair or gland elements, and it was impossible to separate this thin wall from the dura mater. Healing occurred by granulation, and a report twenty-one years later from the patient stated that he had remained free from all head trouble.

**4. In the occipital region.** Walther observed a second case in 1901. A child, aged 3 years, had presented a month before a swelling over the occipital protuberance which was taken to be a cold abscess and cut into. Walther found an oedematous swelling of the nape of the neck with the opening of a sinus over the occipital protuberance. Under chloroform the sinus and an extracranial abscess cavity was scraped out and a hole perforating the occipital bone discovered. After enlarging the incision and cutting away the inflammatory wall of the extracranial abscess including the ulcerating margins of the scalp by which the risk of septic infection was lessened, the occipital bone around the perforation was removed. This exposed a cavity overlying the dura mater covering the posterior part of the occipital lobe, the tentorium, and upper part of the cerebellum. Where the thin wall was in contact with the dura mater it could not be separated. A part of the wall not attached to the dura being removed was found to consist of epithelium without hair or glands. Healing occurred by granulation, the centre of the scar being formed by the epithelial wall united with the dura mater.

The boy was subsequently seen at the age of 15½ years, 12½ years after the operation. He had not had the slightest trouble in the head. The cicatrix masked by the overhanging hair was smooth, lozenge-shaped, slightly depressed, and presenting two grooves meeting at a right angle. Touching the scar provoked a disagreeable sensation of nausea with a vague spreading to the chest.

**5. In the supra-orbital region.** Of more frequent occurrence than the above, perhaps, is one beneath the frontal bone, which is likely to be confused with the common extracranial dermoid cyst above the outer angle of the orbit.

Broca reported that a child aged 2 was operated upon for a dermoid cyst above the outer angle of the orbit. A sinus persisted. At the age of 7 the sinus was found to pass through a hole in the frontal bone, the diameter of a lentil, to a subcranial pocket, the size of a nut. The perforation was enlarged and the persisting remainder of the dermoid cyst was removed.

The foregoing cases are instances of the simplest variety of dermoids, such as form the wens attached to the under-surface of the hairy scalp, superficial to the occipito-frontalis muscle. The wall of these simplest dermoids is composed of stratified squamous epithelium without hair or glands. The sebaceous contents, therefore, must be derived from degeneration of the epithelium. Although these cysts arose between the dura mater and skull they gave rise to no intracranial symptoms but quietly perforated the skull. Only when infection from the outside started suppuration, did the patients suffer. After healing there were no sequelae.

With the foregoing may be compared the more complicated intracranial dermoids growing in or within the meninges. They set up progressive intracranial complications tending towards a fatal issue, especially in young people. They contain hair, and there are sebaceous glands in the wall which seems to be the determining factor in their development and tendency to suppurate, without this being occasioned by infection from the outside.

The common supra-orbital cyst is usually a simple dermoid without hair, and it generally occupies an intermediate position, as it were, between the wen of the scalp and the cases described. It is placed on or in a depression of the frontal bone, underneath the frontalis and the pericranium. In Broca's case a cyst commencing under the skull had come to simulate the common cyst.

As to the wall of the subcranial cyst, in the first case in which suppuration had not supervened, it was nearly all sponged off from the dura. In the second and third cases the wall had apparently been destroyed by suppuration. In the fourth case, in which the ulcerating margins of the scalp were removed, a thin layer of epidermis attached to the dura mater formed the centre of the scar. This is an undesirable termination because touch affects the dura mater and gives rise to disagreeable symptoms. A covering by the scalp avoids this.

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W. G. S.

## THE SURGICAL MEASURES FOR EMPYEMA OF THE THORAX

A very general agreement had been arrived at regarding the surgical treatment of the common form of empyema set up by pneumococcal infection, especially in children. Immediately that a diagnosis had been reached by puncturing with a large hollow needle and syringe, an incision was made in the posterior axillary line, a segment of the 8th (7th or 9th) rib excised, and the pleura opened. Together with the turbid serum or pus, fibrinous masses to a various amount were extracted, the cavity sponged out and adhesions separated to facilitate expansion of the lung. This, if done rapidly, under gas and oxygen anaesthesia in early cases succeeds whenever the pleuro-pneumonia is limited to one side. The patient in expiring and coughing expands the lung, the drainage-tube is gradually pushed out, and healing follows without deformity.

Recent epidemics of 'influenza' have been complicated by streptococcal infection, the turbid exudation occurs early, is thin with little fibrin, and there is less tendency for the lung to form early adhesions. Similar pleural exudation has characterized the pleuro-pneumonia which followed the severe epidemics of measles in the American Military Camps. Also the metastatic infections of the pleura complicating septic wounds have been much the same, hence there has been a marked tendency to revert to former methods which had been discarded.

The reasons given for these revivals of methods which had come to be regarded as inefficient are: that the patients are very weak and liable to heart failure following the shock occasioned by resection of a rib; that repeated aspiration or simple forms of drainage suffice in some cases, and in others the patient so far improves as to stand safely a secondary rib excision; that the relative absence of fibrin formation permits of drainage through a small tube, and there is no occasion for a free opening to remove masses of fibrin or to separate recent adhesions; a free opening into the pleura, when adhesions have not formed early, allows of complete collapse of the lung.

The epidemics have varied much in virulence, and hence there is a possibility that erroneous conclusions may be drawn when considering series of cases of varying degrees of virulence.

But the principal objection to the revival of these older methods is the lack of proof that any marked reduction in immediate mortality has been gained. The death rate among the cases in which these methods have been adopted does not on the whole seem to have varied much from about 25 per cent.

A free opening is the one way of arresting septic absorption whether obvious or latent. This absorption is not only from the pleural surfaces, but also from affected lung, and a free and dependent opening favours drainage from a septic lower lobe.

It has been recommended that the patients should be repeatedly aspirated, or drainage established under local anaesthesia aided by suction. Also there has been a revival of intrapleural treatment, which had formerly been generally dispensed with owing to sudden death occasionally occurring. The Carrel-Dakin irrigation and the injection of various antiseptics have been used.

After repeated aspiration the exudation previously thin, becomes thick and fibrinous, when a secondary resection of a rib and a free opening has had to be resorted to. Owing to the delay the patient has had to survive an extra period of septic absorption, and the lung has had time to form dense adhesions.

Under repeated aspirations, or drainage through a catheter inserted by puncturing with a trocar and cannula, aided by suction, some cases have recovered without requiring further operative treatment. At the same time a number of cases so treated die; it is claimed that the deaths were due to pneumonia, that they might be anticipated in those who presented early cyanosis and were inevitable in cases of early bilateral exudation. The greater number of those who survived required secondary incision with excision of a rib, and only recovered after a long while. After this secondary operation some cases relapsed and died from recurrent pneumonia.

Of the intrapleural measures of after-treatment, the Carrel-Dakin method of irrigation was tried widely in America, and opposite conclusions reached. Those who, it would seem, made such a small opening as would not drain efficiently by itself, found advantage in the addition. Those who made an opening free enough for drainage, found no advantage and indeed drawbacks. The Carrel-Dakin irrigation with its tubes tended to prevent re-expansion of the lung. Apart from the cases cyanosed from the commencement, and hopeless in any case, those who operated immediately upon the discovery of the septic exudation lost no more cases, and the survivors rapidly healed. Indeed, Lilienthal, adopting a long intercostal incision without resecting a rib, claimed to avoid deaths from the operation, and had altogether a mortality of less than 20 per cent.

**Modifications in the operation for empyema.** Lilienthal made a long incision in the 7th intercostal space and separated widely the adjacent ribs by retractors operated by means of a screw. This enabled him to evacuate all pus and masses of fibrin, also to separate adhesions without resecting a rib. The objection to the method was that it was too severe. There were 23 deaths among 100 cases, or excluding 5 moribund, 18 deaths among 93 cases. In very bad cases with thin fluid a puncture might be made with a trocar and cannula and a catheter passed through, but only as a temporary measure.

Duffie made an incision along the 4th rib from the sternocostal articulation for 5–7 inches and removed that length of rib. By retracting the margins of the opening he cleared out the pleura, even passing in his hand until all adhesions were broken down. Then under the guidance of the inserted finger he made a dependent counter-opening in the axillary line through a lower intercostal space and inserted a drain. The upper wound might then be closed. He found no necessity for irrigation afterwards.

Arrou, having found pus by puncturing the chest, incised the 6th or 7th intercostal space and excised a piece of rib. Then by inserting the finger he found the most dependent part of the empyema behind, where he made a counter-opening. He then passed a tube in at one wound and out at the other. He claimed the advantage that there was in this way no inner end of the tube to irritate the expanding lung and cause cough. The tube was kept clean by irrigating through it, but as a matter of fact, after a day or two, the pus tended to find exit beside the tube, rather than through it.

Quénu, in the discussion which followed Arrou's communication, said that he preferred a posterior vertical incision with excision of a rib, then according to the conditions found he extended the opening through the rib above or below.

Berard and Dumet incised the 9th intercostal space in the post-axillary line and the 11th intercostal space in the mammary line, without excising a rib. A tube was passed in at one opening, then out at the other, and it was kept clean by irrigation. Among 26 cases there were five deaths; the cases which recovered healed in about a month.

**Empyema in children.** Comby, at the Hôpital des Enfants-Malades, had under his care 140 cases of empyema, of which 69, 1 short of 50 per cent., died; of the 110 actually treated, 39 (35·5 per cent.) died; 28 died without being diagnosed; 2 died without treatment; 4 cleared up and recovered after puncture, 1 c.c. of pus being withdrawn; 29 were aspirated 2 or 3 times, in one case of interlobar empyema, 7 times, of these 14 recovered, 14 (49 per cent.) died, and in 1 the result was unknown; 77 were treated by drainage, 63 by drainage through the 7th intercostal space, and in 14 a piece of rib was excised, of these 52 recovered, and 25 (32 per cent.) died.

Making all allowance for some cases complicated by tuberculosis, and for children previously badly nourished, the results do not seem favourable.

No mention is made of removal of masses of fibrin, of breaking down adhesions and encouraging the lung to expand. Obviously, the treatment by aspiration was unsatisfactory. The adoption of an earlier and freer policy of operation might have lessened the mortality among those actually treated far below 35·5 per cent.

**Aspiration and drainage through an intercostal space.** Philips, Langman, and Mix at Camp Mills, Long Island, treated:

(1) 17 cases of empyema by repeated aspiration at 3–7 days intervals. 3 healed, in 1 the exudation was serous, in 2 purulent, 2 died but without anything distinctive in the micro-organisms. 5 were subsequently drained without the resection of a rib, in 7 a rib was also resected, one of whom died. The objection to this method was that the aspirating needle became obstructed, also pneumothorax might be produced; severe toxaemia prevented improvement.

(2) 10 cases were drained through an intercostal space, 2 healed in 43 and 45 days respectively; 2 were transferred after 25 and 38 days; 2 were draining after 70 days; 1 had complete pneumothorax; 3 died, although they had no active pneumonia.

(3) 12 cases were drained by resecting a rib, and irrigated daily with Dakin's fluid; 7 had been previously aspirated, and 1 died. 5 were so treated at once; 2 were cured in 4 weeks, and 1 died without pneumonic complications. The rest, viz. 8, were still draining 9–11 weeks after the operation, with collapse of the lung to varying degrees.

(4) 16 cases were treated by suction drainage, the negative pressure being 30–60 mm. Hg. 2 were cured in 10 days, 1 in 21 days, 2 closed in 10 and 20 days and then recurred. 7 cases were complicated by pneumonia and 5 died after being temporarily relieved; 5 were still draining, in 3 the lung had expanded, in 2 not. A catheter was inserted by means of a trocar and cannula and fixed by a shield and strapping. The end of the catheter was connected with an aspirating bottle, and between the bottle and the exhausting syringe a manometer was inserted. But this procedure does not arrest absorption, especially when *Streptococcus haemolyticus* is present, and so death may occur.

Hartwell especially distinguished the primary invasion of the pleura by *Streptococcus haemolyticus*. A velvety surface covers the visceral pleura and there is septic oedema of the subpleural tissues in addition to the infected exudation. He in consequence opposed all other treatment except the establishment of free drainage by the resection of a rib, and the encouraging of the lung to re-expand.

Eggers, at Camp Jackson, South Carolina, treated:

70 cases by drainage and resection of a rib with 19 deaths, i.e. 27 %
24 cases followed primary pneumonia and there were 3 deaths, i.e. 12 %
23 ,, ,, measles and pneumonia and there were 9 deaths, i.e. 39 %
20 ,, ,, secondary pneumonia ,, ,, ,, 7 ,, i.e. 35 %
3 ,, ,, pleurisy ,, ,, ,, 0 ,,
54 ,, were due to pneumococci ,, ,, ,, 9 ,, i.e. 17 %
16 ,, ,, ,, ,, streptococci ,, ,, ,, 10 ,, i.e. 62 %

Aspiration and the postponement of drainage was advocated by Moschowitz. At Mount Sinai Hospital, New York, in 10 years there had been 299 cases of empyema, 133 being due to streptococci, especially following measles, and the mortality had been 28 per cent. At Camp Lee there had occurred 140 cases of empyema, mainly due to virulent streptococci with a very rapid exudation. Aspiration was repeated under novocain anaesthesia until the pus became creamy, when an incision was made between the ribs and Carrel's tubes inserted. He did not however give the results of this treatment.

Rodman observed 240 cases of empyema in camp hospitals between September 1917 and October 1918. They were chiefly due to *Streptococcus haemolyticus,* which had followed violent epidemics of measles complicated by broncho-pneumonia. In one division there were 8,000 cases of measles complicated by broncho-pneumonia and 100 cases of otitis media. In the empyema cases there was a large effusion on the 3rd or 4th day; the fluid was clear with merely flakes of fibrin, but smears and cultures invariably showed *Streptococcus haemolyticus.* By means of X-rays it could be recognized that the exudation started in the interlobar fissure. 50 cases were drained through an intercostal space and 23 died, i.e. 45 per cent.

100 cases were first aspirated several times at 3 to 4 day intervals, and when the exudation had become creamy pus the pleural cavity was drained by resecting a rib, and irrigation, continued with Dakin's fluid through four Carrel's tubes. The mortality was 28.

Then in a second 100 cases a more thorough irrigation was carried out every two hours by the nurses, in the course of which large fibrinous masses were dissolved and washed out; only 10 died.

Of the last 8 cases, due to streptococci, 1 died; 1 had closed in 11 days, 1 in 13 days, the rest in 2–3 weeks. One developed a bronchial fistula and had severe haemorrhage from the lung. It may be questioned whether the epidemic had not tended to become milder in the course of time. Also it may be noted, in comparison with the removal of fibrinous masses at once through a free incision, that in the later cases this was only gradually accomplished by very vigorous irrigation. As to Dakin's fluid, Rodman concluded that the apparent sterilization might be followed by a recurrence of the empyema, and its tendency to excite haemorrhage, was noted only when the lung was becoming gangrenous.

Fulton, at Camp Lewis, Washington, among 240 cases of pneumococcal and streptococcal pneumonia, had 57 cases of empyema. Of these 50 per cent. were streptococcal, 21 per cent. pneumococcal, and the rest a mixture of the two. Drainage with resection of a rib failed to modify the course of the pneumonia; drainage by continuous suction reduced the immediate mortality, but was in the end disappointing; secondary operations were necessary and convalescence was indefinitely prolonged.

Brooks and Cecil, among 80 cases, during a severe influenzal epidemic, had 49 due to streptococci. The empyema developed rapidly with sweating and exhaustion; the chief sign was dullness to percussion. The fluid first removed was a light yellow, which became cloudy and later purulent. Among the 49 cases the mortality was 61 per cent., nearly all having been drained with resection of a rib. They were therefore in favour of postponing the operation until the fluid became gelatinous and purulent.

Diederich experienced great differences in virulence under the same course of treatment. Thus the cases submitted at once to drainage with resection of a rib had in one month a mortality of 47·6 per cent. and the next month under the same treatment the mortality was only 6·9 per cent. Also there were variations among those submitted to aspiration followed later by drainage, using the Carrel-Dakin procedure; the mortality varied between 48 per cent. and 8 per cent.

Lippmann and Samson treated 31 cases, 4 by resection of a rib with 1 death, 7 by drainage and suction followed by rib-resection with 1 death, and 19 by suction drainage alone with 4 deaths. Under this last a case might heal in 3 weeks, after a No. 19 (French) rubber catheter had been inserted through a cannula.

Gerhardt, in Würzburg, treated 20 cases of empyema by inserting a catheter by means of a trocar and cannula, and then maintaining suction by a Sprengel's pump. 14 patients recovered and 6 died (42 per cent.); 2 died of sepsis, 1 of tuberculosis, 1 of pulmonary embolism. He advocated the method as palliative and temporizing whilst pneumonia is subsiding, also in doubtful cases of tuberculosis.

Gage, of Worcester, Massachusetts, put on record cases of empyema at Camp Devens divided into two groups.

| | Group I. | | Group II. | |
|---|---|---|---|---|
| | No. | Died. | No. | Died. |
| I. Early drainage with excision of a rib . . . | 43 | 9 (21 %) | 45 | 9 (20 %) |
| II. Repeated aspiration and postponed operation . . | 17 | 8 (47 %) | 11 | 3 (27 %) |
| III. Neither aspirated nor drained, because undiagnosed | 17 | 17 (100 %) | 5 | 5 (100 %) |
| Total . . . . . . . . . | 77 | 34 (44 %) | 61 | 17 (28 %) |

The difference appears to have lain in the diminished virulence of the epidemic affecting the second group, the high mortality of the patients not drained in the first group being due to an excess of early cyanosed moribund cases. The greater virulence of infection to which the first group were exposed was attributed to a virulent type of pneumococci as well as streptococci.

Those who favoured aspiration and at any rate a temporary delay before drainage put forward the following table:

Drainage with Excision of a Rib.

| | Group I. | | Group II. | |
|---|---|---|---|---|
| | No. | Died. | No. | Died. |
| On the 1st day on which the empyema was diagnosed . | 6 | 3 | 17 | 5 |
| ,, 2nd ,, ,, ,, . . | 10 | 4 | 7 | 3 |
| ,, 3rd ,, ,, ,, . . | 2 | 0 | 5 | 1 |
| After the 3rd ,, ,, ,, . . | 25 | 2 | 16 | 0 |

It is unnecessary to note the fallacies which may underlie such a table.

In the discussion which followed, Codman, of Boston, said that at Camp Zachary Taylor there had been probably a greater incidence of empyema than at most other camps, and he had reached the conclusion that drainage with excision of a rib should be postponed until the severe primary infection and pneumonia had subsided. On the whole, drainage through a small tube, preventing the entrance of air beside it, was better than a more open wound with Dakin's tubes, being less likely to cause collapse of the lung.

Lincoln Davis, of Boston, who had had experience of empyema among negro labour battalions at Bordeaux, also approved of delay during the fulminating stage. This stage should be tided over by tapping until the process localized itself 'and if it does not localize, there will be a natural selection of cases which will improve the operative mortality at any rate' (!)

**Bilateral empyema.** Norrlin advocated repeated aspiration and postponement of drainage in cases of threatened or actual double empyema. Among 588 cases of empyema in 23 Swedish hospitals, there had occurred 5 cases of double empyema, only one of which had gone out cured. As is usual in these cases, the empyema on the second side developed after an interval. Hence Norrlin did not really show any advantage over what had been previously advocated, viz. the incision with resection of a rib on the first side at the earliest moment, so that the patient would be able to undergo a similar operation on the second side after a few days.

**Interlobar empyema.** Observations by means of X-rays at the commencement of pleural exudations tend to mark the interlobar region as the commonest starting-point. Generally there is extension forthwith to the more dependent parts of the pleura, but occasionally the exudation becomes walled in by adhesions. This happens especially in children. The physical signs are obscure owing to the lobe of the lung below becoming compressed. A good X-ray photograph affords the clearest evidence. After a period of hectic fever, the loculated empyema may burst into the bronchus and complete recovery follow.

Broadbent recommended for diagnosis a puncture through the 2nd or 3rd intercostal space in the anterior axillary line. Clairmont, after giving a full account of the subject, especially from French literature, concluded that all treatment was unsatisfactory except direct opening as recommended by Rochard in 1892. An incision is made through the 5th intercostal space, the margins of the interlobar fissure recognized, and the abscess opened by a blunt method. Or an exploratory trocar may be passed in and the opening follow the trocar. Then the cavity is drained but not irrigated. If there is a communication with the general pleural cavity, a dependent counter-opening will be necessary.

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## DIVERTICULA OF THE BLADDER

Diverticula of the bladder constitute an insidious danger tending to a fatal ending, to prevent which diagnosis and surgical treatment during the earlier stages is essential.

The dangerous condition is due to the stagnation and decomposition of urine in the pouches, which may be followed by the formation of calculi or the development of polypi and carcinoma in connexion with the diverticulum. Septic cystitis is kept up in the bladder by alkaline and purulent urine from the sac, which is followed by septic extension to the kidneys, causing progressive pyonephrosis and sacculation. The thinned wall of the diverticulum may perforate and set up fatal peritonitis and pelvic cellulitis.

Diagnosis in the earlier stages has been rendered much more easy by the cystoscope, through which the opening between the bladder and the diverticulum may be seen. Also cystograms by means of the X-rays after the bladder and diverticulum have been filled with collargol enables the outline of the sac and its dimensions to be recognized, and in accordance with its position its removal may be undertaken. This surgical operation is successful before the kidneys have been destroyed.

The diverticula are for the most part acquired, following upon obstruction to the emptying of the bladder. But there are congenital malformations associated with the production of the diverticula in early life. The diverticula are more commonly met with in later life as the result of obstruction from enlargement of the prostate or stricture of the urethra. The occurrence of diverticula is also noted under other headings: hernia of the bladder, sacculated and encysted calculi, atony of the bladder, cystocele in women, cysts and calculi in the urachus.

Following Cruveilhier, the diverticula were described as a bulging out of the mucous membrane between the muscle fibres. This is an incorrect statement. The protrusion consists of the muscular wall as well as of the mucous membrane, the muscle fibres being thinned out in varying degrees or replaced by inflammatory fibrous thickening, like the rest of the bladder-wall when it undergoes the so-called hypertrophy.

**Diverticula due to obstruction following prostatic enlargement and stricture of the urethra.** The obstruction which causes a diverticulum may be set up, not only by a readily recognizable enlargement of the prostate, but also by more obscure conditions referred to in the previous number of *Medical Science*, and by some in America termed the 'silent prostate'. The stricture of the urethra may be caused by injury as well as by gonorrhoea; also chronic gonorrhoeal urethritis and prostatitis, without producing a marked narrowing of the urethra, may set up a thickening of the bladder-wall which induces sacculation.

The history of bladder trouble given by the patient may be that characteristic of stricture following gonorrhoea, or of prostatic enlargement. There may be a long history of increasing trouble which may be traced to gonorrhoeal infection. The part of the patient's complaint which suggests the existence of a diverticulum is that of the passage of clear urine, alternating with or ending by the escape of ammoniacal urine thickened by muco-pus. This observation by the patient may be confirmed in the course of catheterizing and washing out the bladder, owing to the irregular evacuation of the pouch. When the diverticulum has become large the patient may complain of irregular arrest in micturition, or of partial retention, and then the existence of a diverticulum may be detected by bimanual palpation. In neglected cases the patient may be seen for the first time suffering from perforation and extravasation of urine.

The examination by the cystoscope brings under view the junction of the diverticulum with the bladder. It should precede the X-ray examination, for if not it may be difficult to empty the pouch of the collargol, and the view through the cystoscope will be obscured.

The cystogram obtained by means of the X-rays after filling the bladder and the diverticulum with collargol supplies important information to the surgeon as to the position and dimensions of the diverticulum, and the character of its junction with the bladder, whether sessile or more rarely pedunculated. Before introducing the collargol an X-ray skiagram, with the bladder filled with water or air, will allow of the detection of a calculus, whether situated in the diverticulum or in the main bladder, or the calculus may be hour-glass in shape, part in the diverticulum, part projecting into the bladder.

The commonest situation for a diverticulum is alongside the termination of the ureter; apparently the oblique passage of the ureter through the bladder-wall is the explanation why the bladder yields more commonly at this spot. The diverticulum in this position, as it enlarges, compresses the lower end of the ureter and so adds to the obstruction caused to the termination of both ureters by the thickening of the wall of the bladder. Hence the kidney on the side upon which the ureter is compressed by the diverticulum is the more quickly destroyed. It may determine the death of the patient and be found at the post-mortem examination reduced to a multilocular abscess cavity, whilst the opposite kidney is still in the stages of early septic pyelitis.

The removal of the diverticulum is indicated whenever possible. Only in late cases may it be advisable to drain the bladder through a suprapubic opening, in some cases with a drain of the diverticulum by the perineum. If this is followed by an improvement in the patient's condition an opportunity for the removal of the diverticulum may be gained.

**The intravesical method** has been adopted with increasing frequency by H. H. Young, whenever it has been found possible to invaginate the diverticulum into the bladder, after opening the bladder above the pubes. The invagination may be accomplished by pressure from the rectum, also by traction, forceps being passed through the orifice communicating with the bladder so as to seize the fundus of the diverticulum from within. But Young has adopted in particular cases suction to induce invagination, the apparatus being similar to Bier's suction apparatus. A glass suction tube, of a size which will enter the diverticulum, is applied to the inner wall. Invagination can thus be obtained in early cases, when external adhesions have not become established. Excision and suture can then be proceeded with from within the bladder, care being taken to avoid the adjacent ureter. The bladder is next sutured, a drain being inserted in the suprapubic wound outside the bladder. Young noted seven successful cases. An incidental danger may be incurred by a coil of intestines following the invagination of the diverticulum—whether previously adherent to the outer surface of the pouch or not. If a calculus is found impacted in the sacculus, the stone and the diverticulum should be excised together. Only when the stone is found in quite a shallow sacculus has it been removed and the pouch left—in the anticipation that the latter will undergo spontaneous disappearance. On the other hand the persisting diverticulum may give trouble as in Pels-Leusden's case.

The **extravesical, extraperitoneal** excision of a sacculus has been largely practised through a suprapubic incision by stripping off the peritoneum from the thickened bladder until the sacculus in the neighbourhood of the ureter can be separated and excised, the opening into the bladder being carefully closed by sutures. It is very important to preserve the ureter and its sphincter at its junction with the bladder. An early case by Czerny illustrates this. A man at the age of 30 ruptured his urethra by falling astride. Cystitis followed, and the urine became very foul. Four months later, upon suprapubic exploration, a diverticulum the size of an apple was discovered adjacent to the left ureter. An extraperitoneal excision of the diverticulum was done together with a division of the ureter and its reimplantation into the bladder. Severe septic pyonephrosis of the left kidney ensued, and three months later nephrectomy became necessary. There was delay in the healing of the suprapubic fistula, but in the end the man recovered completely.

Judd, describing experiences in the Mayo Clinic, stated that in 44 cases 39 diverticula were near the ureteral orifice. Through a suprapubic cystotomy, the finger was introduced into the diverticulum and under this as a guide an extravesical, extraperitoneal separation of the sac was accomplished by blunt dissection, special care being taken to avoid injuring the ureter and vas deferens. 10 out of the 44 cases died of renal complications soon after the excision of the diverticulum, but none from the operation itself.

**The intraperitoneal method** adopted by Watson Cheyne and Everidge has great advantages, especially when the diverticulum has a tendency to be pedunculated, as is well shown in the cystogram of their case. The approach is a direct one without the subsequent danger from prolonged suppuration as the result of stripping off the peritoneum from the wall of the bladder; also a slowly healing urinary fistula may be avoided. Watson Cheyne, with the patient in the Trendelenburg position, exposed the bladder through a hypogastric incision. The bladder was then completely shut off from the rest of the abdominal cavity by packing, flaps of peritoneum turned aside, the diverticulum excised, the bladder-wall sutured, and then over this the peritoneal flaps. The abdominal wound was completely closed and the patient made a good recovery.

**Dilatation of the bladder and diverticula in early life, the so-called congenital diverticula.** Diverticula have been described as following both spina bifida and spina bifida occulta. Although in early life there is incontinence of urine so that the bladder is kept empty, subsequently there is an overaction of the sphincter and a paresis of the detrusor urinae. In Mucharinsky's case a boy aged 17, the subject of lumbosacral spina bifida, after suffering from retention of urine, died, and there was found a dilated and thickened bladder with diverticula, thickening and dilatation of the ureters, and bilateral pyelonephrosis.

Pfanner recorded a case of sacral spina bifida occulta in a boy who at the age of 16, after suffering from retention with overflow, died from extension to the kidneys. There was a diverticulum the size of a walnut close to the left ureter, and also a partially patent urachus.

A congenitally formed fold on the posterior margin of the internal vesical orifice was found by Eigenbrodt in examining the interior of the bladder through a suprapubic wound. The symptoms of the case beforehand had resembled those of prostatic hypertrophy. He cut out the fold and the case was cured.

A case was noted after death by Poppert. A man aged 24, from childhood had suffered from dysuria, retention, and cystitis. Catheterization was difficult and the cystitis increased. Death from uraemia followed 24 hours after perineal cystotomy and drainage. A semilunar valvular fold had obstructed the internal vesical orifice and had caused marked thickening and dilatation of the bladder.

In the case of a boy aged 9 there had been pain and difficulty with micturition from the age of 3. He had on several occasions passed blood in the urine and had been sounded several times for stone. The bladder could be easily distended up to the umbilicus. On exploration through a suprapubic wound there was no sign of an encysted calculus, but the neck of the bladder bulged for an inch into the bladder, and the interureteral band was very marked. Here the obstruction seemed due to a thickening of the whole ring of the bladder-wall rather than to an actual valvular fold. But this latter may have been altered by the previous soundings. The passage of a No. 5 English bougie met with resistance at first, but the internal orifice was gradually dilated up to No. 12 English and the suprapubic incision was closed. A recovery followed and there was no return. In two other small boys with a similar history the gentle dilatation of the neck of the bladder up to No. 12 English afforded relief without any cutting operation.

A fourth case died at the age of 22. The patient's history of urinary trouble dated from the age of 14, before which he had been quite healthy except for scarlet fever at the age of 3. At the age of 14 he was admitted to a medical ward for haematuria, where he remained for four months. The following year he was again admitted for haematuria, and, the bladder being found dilated, he was catheterized every day. When he failed to improve, a suprapubic drain was inserted, the bladder-wall being found thickened, but nothing further was noted. After temporary improvement the suprapubic fistula was allowed to close, but in the following years the fistula leaked intermittently. The man came again under care six weeks before his death. There was marked atony of the bladder, 62 oz. of urine were drawn off, and then the bladder was distended with 155 oz. of water, so that the fundus reached nearly to the xiphoid cartilage without the patient being disturbed. The distended bladder could be easily palpated as the man had wasted. The dresser repeated this observation several times. It was obvious that the patient was suffering from bilateral pyonephrosis, and so both ureters were exposed and the proximal ends brought out upon the loin. Both ureters were enormously distended and tortuous, so that they resembled the ascending and descending colon. The patient was so far relieved that the percentage of urea rose from 0·55 per cent. before the operation to 1·1 per cent. after the operation. He might have lived longer had he not been attacked with septic pneumonia a few days before his death, 20 days after the bilateral ureteral drainage. The post-mortem examination showed both kidneys reduced to dilated sacs and there was extensive septic pneumonia at the base of the right lung. The extraordinary feature was the bladder, which had contracted down, so that it seemed a thick-walled sac which would hold about 20 oz., besides which there was nothing abnormal to be made out. Yet it had been enormously distended during life as described above. The conclusion arrived at was that following upon an obstruction of congenital origin, atony of the bladder had set in, and no recovery had followed the suprapubic drainage, nor the dilatation of the neck of the bladder.

Shattock discussing such cases under the heading 'Is there an "Idiopathic Dilatation" of the Urinary Bladder?', after quoting previously recorded cases referring to dilatations of the colon and oesophagus, appears to conclude that the pathology is similar to that referred to above as following spina bifida, a tendency to overaction of the sphincter and a paresis of the detrusor urinae.

Thomson Walker referred to 12 cases of atony of the bladder not explained by obvious obstruction or nervous degeneration. In order therefore to prevent atonic dilatation of the bladder as well as the development of diverticula in boys, it is necessary to dilate the neck of the bladder with all gentleness up to at least No. 12 English.

**Posterior diverticula of the bladder.** Next in frequency to the formation of the diverticulum adjacent to the orifice of the ureter is the posterior diverticulum which bulges backwards immediately above the interureteral fold towards the rectum in the male, by stretching and separating the fibres of the levator ani. As it enlarges, and especially if the communication with the bladder is narrow, the diverticulum tends to press forwards the trigone and prostate so as to cause retention. On rectal palpation a tense elastic swelling may be noted, which has been confused with an enlargement of the prostate. If the communication with the bladder is wide the contents of the diverticulum may be emptied into the main bladder and withdrawn by the catheter, after the bladder has been previously emptied.

Phosphatic concretions and calculi are apt to form, and calculi have ulcerated through the diverticulum into the rectum.

Davrinche recorded the case in which at the age of 7 a calculus the size of a hen's egg had been expelled per anum; 24 years later, at the age of 31, the man only occasionally passed urine by the penis, but regularly by the anus; the rectum had become tolerant, so he was not incontinent. Apart from the formation of a stone such a diverticulum may be mistaken for an abscess in the front wall of the rectum.

A posterior diverticulum may be temporarily relieved by drainage suprapubically, or by the perineum. Krogius, through a suprapubic wound, passed a catheter into each ureter, and then made a posterior median incision through the middle of the prostate and trigone upwards to the lip of the diverticulum so as to open a free communication with the bladder. Partial improvement followed.

Zaaijer related the case of a man aged 58 with retention of urine, caused by a large posterior diverticulum. After six weeks of suprapubic drainage, the peritoneal cavity was opened and the diverticulum invaginated, when it was excised from within the bladder. The suprapubic wound was closed, and perineal drainage established. The diverticulum was 8 cm. in diameter, and had a wall 0·5 cm. thick. Two years later the patient was still suffering from chronic cystitis. In the discussion on the case von Capellen mentioned a similar one with the same result.

For an old-standing and posterior pouch removal through a parasacral incision has been done. A man aged 53 had had bladder trouble for 9 years ending in retention, and 2·5 litres of urine were drawn off. On exploration a diverticulum above and behind the prostate was found, holding 1·7 litres of urine, and the bladder was drained. At a second operation Quervain extirpated the diverticulum through a parasacral incision; it was densely adherent. At a third operation two small nodules were excised from the prostate, and the patient in the end made a good recovery. In the first case of this operation, described by Pagenstecher in 1894, a urinary fistula in the sacral region persisted.

**Posterior diverticula of the bladder in the female.** Passing over the subject of the common type of cystocele and its connexion with uterine prolapse, posterior diverticula may occasion errors of diagnosis.

Péan, in a girl aged 15, who had suffered since birth from incontinence of urine, found a diverticulum of the bladder bulging into the front of the vagina, and opening by a minute orifice, 3 mm. above and behind the meatus of the urethra. This abnormal orifice communicated with the bladder. The diverticulum was excised, and healing followed. Péan did not supply any evidence as to the communication of diverticulum with the main bladder and the relation to the ureteral orifices. He called it a supplementary urethra.

Chaput mistook a diverticulum for a vaginal polypus. A woman aged 50 had suffered from bladder trouble for five months including intermittent retention. The bladder was distended above the pubes and in front, and to the right of the cervix uteri was what appeared to be a fibromatous polypus. On being cut into, it was found to be a large diverticulum of the bladder containing phosphatic concretions. The diverticulum was drained by the vagina, and the bladder by the urethra; after treatment by frequent irrigations healing occurred, and nothing abnormal could be seen when the interior of the bladder was examined by the cystoscope.

Katingkoff noted a case in which a diverticulum had been cut off by the woman herself. A peasant bore her third child at term, unaided, and three days later, feeling something project from the vulva, and thinking it a piece of afterbirth, cut it off. There was found, on medical examination, a vesico-vaginal fistula which admitted a finger, but which closed spontaneously in nineteen days.

The bladder in the female may bulge somewhat into the base of the broad ligament, and it affords an explanation of the condition met *post mortem* in the case described by Hale White. The patient had died of septic cystitis followed by multiple abscesses in the right kidney. She had had no obstruction to micturition, nor was there any sign of spinal disease. On the inner aspect of the bladder, midway between the left ureteral meatus and the internal orifice of the urethra, there was an opening $\frac{1}{3}$ inch in diameter, which led into a cavity situated to the left and in front of the bladder, larger than the cavity of the bladder itself. The sac contained grumous urine and muco-pus. To the right of the uterus, between it and the bladder, was a thin-walled cavity, the size of a walnut, containing pus. All else was healthy.

**Neglected diverticula of the bladder.** Diverticula may give rise to fatal perforation, also to malignant disease.

Shaw, in 1854, recorded a case in which a posterior diverticulum, opening just behind the prostate, and of the size of half an orange, ruptured on its upper aspect and caused fatal pelvic cellulitis and peritonitis.

The following three cases came under observation. A surgeon finding a stone by means of the sound, crushed it to his satisfaction, and after evacuating the fragments, nothing more could be touched by the sound. The patient died two days later from acute septic peritonitis. The surgeon had crushed the projecting half of an hour-glass stone. The other part had been rotated in the pouch through half a circle, so that the jagged fractured surface, brought into contact with the fundus of the diverticulum, had perforated it.

A medical man, as far as was known, had not realized that he was suffering from the late results of an enlarged prostate. He was found in a semiconscious 'typhoid' condition with pelvic peritonitis from infection from a posterior diverticulum, but without extravasation of urine. He was not relieved by drainage of the peritoneum, as well as of the bladder, and died two days later.

Another practitioner, who also had no idea of his state, presented signs of extravasation of urine which had already spread from the perineum to the scrotum and penis. There was the extraordinary addition of signs of extravasation into each ischiorectal fossa. An immediate operation disclosed the typical results in the perineum and scrotum; there was septic fluid in each of the tunica vaginalis, and septic oedema of the prepuce, and also slightly of the subcutaneous tissue over the external abdominal rings. But besides all this both ischiorectal fossae were infiltrated. The urethra was normal, there was enlargement of the prostate, and around the neck of the bladder and above the prostate posteriorly gangrenous cellulitis. There was no further extension after free incisions and drainage, and he lived a week without signs of peritonitis, dying of exhaustion and basic septic pneumonia.

Wallis described the rupture of an anterior diverticulum resulting from the stricture which had followed amputation of the penis. A man aged 69 was admitted to Charing Cross Hospital in extremis. He had undergone amputation of the penis in front of the scrotum twelve years before, and there was a stricture at the end of the urethral stump. The bladder contained only ½ oz. of blood-stained urine. There was a large swelling in the hypogastrium, found to be due to a properitoneal extravasation of urine owing to the rupture of a sacculus.

The occurrence of polypi and carcinoma in diverticula of the bladder was described by Targett in 1896 from specimens preserved in various London museums, as follows: At Guy's Hospital a carcinoma in a diverticulum alongside the left ureter; in the College of Surgeons an epithelioma occupying the margin of the diverticulum, a sloughing epithelioma in a posterior diverticulum, also an epithelioma with a calculus in another posterior diverticulum; at St. George's a sessile fimbriated papilloma springing from a sacculus above the left ureter, discovered *post mortem*; at Middlesex Hospital, a diverticulum containing a carcinoma larger than the bladder, opening into it one inch above the left ureter; at St. Bartholomew's a posterior diverticulum almost as large as the bladder contained an epithelioma, the wall of the diverticulum, where not invaded by the malignant growth, was lined by apparently normal mucous membrane. Similar cases have since been recorded by others.

**Cystic dilatation of the lower end of the ureter.** This appears to originate either as the result of a constriction of the ureteral meatus or by the passage down the ureter from the kidney of a calculus which fails to pass through the meatus. Stenosis of the ureteral orifices can be noted by means of the cystoscope; the urine may be seen intermittently to balloon out the orifice, or cause an actual cystic swelling with the ureteral meatus prominent. The protrusion of the ureteral orifices may be seen in a child with extroversion of the bladder, the inflamed and swollen mucous membrane around the papilla, checking the escape of urine.

In the eighteenth century Couillard stated that a calculus travelling down the ureter, instead of escaping into the bladder, might become lodged in a dilatation of the lower end of the ureter which gradually bulges into the bladder. Such stones were described by Houstet in 1743 as encysted and adherent to the bladder. Operating from the perineum, he laid open such a cyst and removed a calculus the size of a hen's egg. Desault using his uvula guillotine slipped it over a pedunculated cyst protruding into the bladder and cut it off between the bladder wall and the cyst. In recent times such encysted calculi have been removed by suprapubic cystotomy, e. g. by Hurry, Fenwick, and Freyer. In a case from which a specimen in the Museum of the Royal College of Surgeons was taken, a pyriform sacculus containing three calculi had prolapsed into the prostatic urethra, the diagnosis beforehand being that of a calculus impacted in the urethra. On perineal section the pedicle of the cyst, the size of a lead pencil, was traced up to the neighbourhood of the left ureteral orifice where it was cut through by the actual cautery. The man recovered from all urinary trouble.

A specimen of a bilateral prolapse of both ureteral orifices described by Thomas Smith is preserved in St. Bartholomew's Museum and a similar specimen by MacCormac in the Museum of the Royal College of Surgeons. In Davies Colley's case there was prolapse of the cyst through the urethra of a female child aged 18 months. Straining and bleeding during micturition drew attention to a red mass projecting from the urethra. A catheter was inserted into the left ureter, and the neck of the protrusion was tied without including the ureter. The child died 9 days later, when there was found a left kidney sacculated and full of pus. Davies Colley concluded that it was due to the passage of a calculus, as the function of the ureter and bladder was normal. Apparently no stone was actually found and the ligature and the protrusion had sloughed away before death. Other cases of the prolapse, including the ureter, through the urethra of little girls have been noted. It is obviously necessary that the ureter should be protected by inserting a catheter before removing the protrusion. Most of the cases have proved fatal.

Caillé, in a child aged 2 weeks, who presented a swelling protruding from the urethra, applied a ligature, cut away the swelling beyond the ligature and pushed back the ligatured pedicle into the bladder. The child died, and then was found a sacculated right kidney with a double ureter ending in a single tube above the vesical orifice. The left kidney showed acute septic nephritis. A small papilloma near the termination of the right ureter obstructed the lumen; the ureter had become dilated above and had prolapsed.

**Hernia of the bladder.** A distinction may be made between a diverticulum formed as the result of increased pressure within the bladder and a hernia as the result of external traction by which a cone of the bladder is drawn into a hernia. But the general effect is the same, stagnation and decomposition of urine, tending to the formation of a calculus, and to set up septic cystitis which in the end destroys the kidneys. There is also the danger of septic perforation of the hernia into the scrotum and into the pelvic cellular tissue. Moynihan in 1900, in his lectures on 'Rarer Forms of Hernia' included that of 'Hernia of the Bladder'.

Hernia of the bladder is most commonly met with in old-standing cases of inguinal hernia, less often femoral, and forms a thickening on the inner side of the neck of the hernia. The cystocele is acquired by a dragging on the peritoneum attached to the bladder. The inguinal hernia may be either direct or indirect at the commencement. A direct hernia with the deep epigastric artery running across the neck of the sac should be carefully examined on the inner side for a cone of the bladder.

But the hernia may well be at first an indirect hernia. The drawing accompanying Pilcher's paper in 1853 shows the deep epigastric on the inner side of the sac. Such hernias of the bladder occur with large scrotal hernias. It often happens in the course of separating the sac of an inguinal hernia that when the funnel of the peritoneum is reached above the internal ring that a pad of fat appears on the inner side. This pad may conceal a cone of the bladder, and it would be an unfortunate mistake to include it in the ligature applied to the neck of the hernial sac.

Treves, in 1895, published the case of a man of 31 who had been putting on fat. He presented on the right side a bulging of fat behind the spermatic cord which was beginning to descend into the scrotum. It contained a pouch of bladder. Treves considered that the case illustrated an early stage of hernia of the bladder, an increase of subperitoneal fat tending to descend into the scrotum dragged after it a cone of the bladder.

When the bladder is found in bubonoceles, there may be a general weakness of the abdominal wall, a sort of ventral hernia in which the deep epigastric artery runs across the middle of the swelling. In two cases of this kind the bladder was closely adherent to the hernial sac. The separation of the bladder and the extravesical fat from the hernial sac should not be done by use of anatomy forceps, for it is quite easy to tear into the bladder; the pouch of bladder should be detached by pushing it off the hernial sac with a pad of gauze.

Cases of hernia of the bladder complicated by inflammation may be indicated before the operation by pain and tenderness, after the incision by the oedematous condition of the extravesical fat. The inflammation may be set up by the stagnation of urine in the pouch, which thus causes swelling. Partial strangulation follows at the angle between Poupart's and Gimbernat's ligaments. The danger lies in septic inflammation having extended to the wall of the bladder above the level of the constriction. In a recent case the pouch of bladder surrounded by oedematous fat was separated and pushed back; the hernial sac of the inguinal canal was then treated in the usual way except that a drain was inserted with the inner end in contact with the reduced hernia of the bladder. The patient died of pelvic cellulitis and peritonitis with extravasation of urine owing to septic inflammation and perforation of the bladder-wall above the level of the junction of the pouch with the rest of the bladder. The old method of treating gangrenous strangulated hernia should have been adopted; the constriction should have been divided, but the hernia of the bladder should not have been reduced.

Monod and Delagenière in 1889 reported three cases of hernia of the bladder; two cases, after the cone of bladder had been cut into and sutured, healed. In a third case of inflamed hernia, the pouch was reduced without being cut into. Extensive suppuration followed, then septic pneumonia, and the patient died on the 13th day after the operation.

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W. G. S.

# THE REPRESENTATION OF THE BLADDER IN THE CEREBRAL CORTEX

Reviewing the literature on the innervation of the bladder, Fearnsides finds that there is little accurate knowledge of the central efferent paths connected with the voluntary control of micturition. There have been several experimental observations indicating the existence of a centre for the bladder in the region of the motor cortex. As long ago as 1839, Valentin produced movements of the bladder by electrical stimulation of the cerebral peduncle, the thalamus and the corpus striatum. More recently, Bechterew observed bladder contractions in the dog on stimulation of the sigmoid gyrus, while in the monkey, Sherrington obtained somewhat similar results.

As a result of his observations on the clinical side, Rehfisch (1897) concluded that the so-called internal sphincter of the bladder was under voluntary control, but Starling (1900) thought that his results might be explained equally well by contraction of the voluntary perineal muscles.

**Clinical observations.** (*a*) **Tumours of the brain.** In 1901, Czylharz and Marburg described a case of tumour of the brain involving the angular and supramarginal gyri and the middle third of the post-central convolution. The patient had difficulty in passing urine. From a study of recorded cases of bladder disturbances from cerebral lesions, these authors concluded that there is a motor centre for the bladder closely associated with the leg and arm areas of the motor cortex. More recently, Brouwer (1916) has recorded a case of tumour of both frontal lobes, the corpus callosum, and the basal ganglia on one side, in which the patient suffered from disorders of micturition.

A similar observation has been made by Friedmann (1904) in a case of depression of the skull over the post-central convolution in a boy who had difficulty in passing urine and later developed incontinence.

Tumours of the brain are progressive lesions, they produce widespread compression of the brain and are often associated with mental change. In these circumstances the attempt to determine the existence and the seat of a motor centre for the bladder must be fraught with great difficulty and be exposed to many possibilities of error. In this respect, the opinion of Gowers is interesting. In his text-book, he states that ‘ the sphincters are not often paralysed from intracranial tumour, and the loss of power over them is of no special significance. Untimely evacuation of bladder and of rectum is, however, very common in association with the mental apathy and dullness which are so common in tumours of all parts ’. Patients with tumours or abscesses of the frontal lobe not uncommonly wet the bed, and it is doubtful if this fact has ever been regarded as of any localizing significance as far as the functions of the bladder are concerned.

On the whole, therefore, cerebral tumours do not provide conclusive evidence of the seat or even the existence of a cortical centre for the bladder.

(*b*) **Wounds of the skull and brain.** The problem has been taken up again during the years of the war by several observers. From a study of cases of gunshot wound of the brain they have reached the conclusion that there is cortical representation of the bladder. However, there does not appear to have been any detailed study of the disorders of micturition observed, nor is the information given as to the site and extent of the cerebral lesion in these cases as complete as one would wish. In one instance, for example, localization has been attained solely by means of cerebro-cranial topography, a method which would be adequate only if a lesion had position but no magnitude.

O. Förster, Kleist, Bychowski, Auerbach, and Adler have described disorders of micturition following wounds of the vertex of the skull, while Pfeifer found similar symptoms from more laterally placed injuries over the motor region. (Vide *Medical Science*, 1919, **3**, 341.)

If clinical material is to be used for physiological observations, it is essential to have accurate knowledge of the cortical areas affected and of the full extent of the lesion. Except in the cases of Pfeifer, the injury in every instance was a tangential wound in the midline of the vertex of the skull. According to Bychowski, the superior longitudinal sinus, seen in the depth of the wound or exposed at operation, was thrombosed or occluded by the pressure of bone or projectile. The adjacent cortex was covered by a film of clot, and the mesial borders of both hemispheres in the Rolandic region were contused. He states that accurate localization of the area affected was, under the conditions prevailing, not possible.

Kleist and Adler give no details beyond stating that the mesial ends of both precentral convolutions were injured. O. Förster is quoted by L. R. Müller as saying that in all his cases with bladder disturbances there was bilateral contusion of the cortical 'foot centre'. The only exhaustive account of the brain injury found in cases of this type is given by Holmes and Sargent in their paper 'on injuries of the superior longitudinal sinus'. They observed over seventy cases of this nature. In many of them there was no penetration of the skull, but in all there were gross disturbances of the cortical venous circulation. The sinus was usually thrombosed: the veins leading into it on both sides were always distended by hard clot. There was softening of the mesial parts of the adjacent cortex, and in some cases widespread subdural haemorrhage extending round to the base. Microscopically, they observed oedema of both white and grey matter with minute haemorrhages in the brain substance. As their photographs indicate the injury was very extensive.

Thus, the type of brain injury from which it has been attempted to determine the cortical centre for the bladder, is associated with gross and extensive damage to the cortex and the subcortical white matter. The material is therefore unfavourable for physiological investigations.

The clinical symptoms found in these cases were, on the motor side, spastic paresis of both legs and sometimes of an arm. Sensory disturbances were present in the majority, from injury of the post-central cortex.

The bladder defect noted in Förster's cases was retention of urine necessitating prolonged catheterization and followed by persistent difficulty in passing urine. Of Kleist's four cases, three had incontinence of urine and one retention, and these symptoms did not last longer than two weeks in any of them. Adler's two cases suffered from sudden involuntary emptying of the bladder, but were unable to start micturition at will. Auerbach, quoted by L. Müller, found retention or difficulty in starting voluntary micturition. In his cases these symptoms were of long duration. Holmes and Sargent, who do not deal with the physiological aspect of this feature of their cases, state that the bladder functions were affected in some of their patients. The common defect was retention lasting for a few days and less frequently incontinence 'owing to deficient cerebral control'. This persisted for a considerable time and they add that 'the bladder apparently emptied itself reflexly when it had filled to a certain point, and some patients explained that they were able to hold their water for a few moments only after the desire to micturate had come'. Cushing, who regards the 'longitudinal sinus syndrome' as due to contusion of the cortex, does not mention bladder symptoms in the three cases of this condition recorded in his paper.

The frequency and possible influence of psychical disorders is not specifically mentioned by any of these writers and it is probable that they are not of any significance.

**Physiological considerations.** Förster and Kleist conclude that the cortical motor centre for the bladder lies on the mesial surface of the hemisphere in the paracentral lobule. In Adler's cases this is the situation indicated also. In all the series the injury was bilateral and involved the corresponding areas on both sides, though not always equally. In Pfeifer's twenty cases of disturbed vesical function the lesion was bilateral in seven only, and cerebro-cranial measurements placed the centre between the leg and arm areas, in the neighbourhood of the hip centre. Adler attempts to correlate Pfeifer's observations with those mentioned above, by supposing that there must be two bladder centres; one on the mesial surface of the cortex in the paracentral lobule controlling the voluntary emptying of the bladder; the other placed between the leg and arm areas on the convexity of the hemisphere and regulating the voluntary retention of urine. He bases this distinction of function on the ground that in Pfeifer's cases the symptom was retention from the outset, while in his own and in Kleist's cases it was always incontinence.

It appears, however, that retention, difficulty in starting micturition, sudden periodical incontinence, combinations of these symptoms and finally a complete absence of any bladder disturbance may result from lesions of the mesial ends of both motor regions of the cortex. Further, both types of defect were seen by Pfeifer. There is, therefore, no foundation for the distinction drawn by Adler. Moreover, the character and extent of the brain injury in the cases showing these symptoms, clearly will not allow of such refinement of localization as Adler supposes.

A more important point is that in every instance the brain injury was bilateral. It is true that in the majority of Pfeifer's cases the lesion is said to have been unilateral, but since no direct examination of the brain was made, the extent of the lesion was never determined.

In these circumstances it is reasonable to compare the bladder disturbances from cerebral lesions with the anarthria and dysphagia of pseudobulbar paralysis. In both instances we are dealing with bilaterally acting structures. The infrequency of a double lesion of the paracentral lobules would thus account for the fact that disorders of micturition are so seldom seen in cerebral lesions.

The criticism made by Starling on Rehfisch's view has recently been revived in connexion with the observations recorded here by L. R. Müller. He regards the cortical control of the bladder as indirect. Voluntary micturition is started and ended by voluntary contraction of the striated perineal and pelvic muscles. This contraction reflexly excites the smooth musculature of the bladder and urethra through the action of the involuntary nervous system. There is therefore no true bladder centre in the cortex. A double lesion of the paracentral lobule produces disturbed bladder function by interfering with the voluntary innervation of the striated perineal musculature.

It is very doubtful, however, whether voluntary micturition is affected in this roundabout manner. In the normal act the involuntary musculature of the bladder and the striated muscle of the urethra are both concerned. We may assume that, like the rest of the skeletal musculature, the latter has a cortical representation. Since, in Hughlings Jackson's words, movements and not muscles are represented in the cortex, it is more probable that the act of micturition is controlled from the cerebral cortex, than that certain voluntary muscles playing a part in the act of micturition should have isolated representation. Moreover, the extreme importance of voluntary control over the functions of the bladder throughout the history of the race and that of the individual renders it highly probable that these functions are directly represented in the cerebral cortex.

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F. M. R. W.

# ABSTRACTS

## SURGERY

**Perol, G.** Anesthésie à la stovaïne en chirurgie et en médecine vétérinaire. [**Anaesthesia with stovain in veterinary surgery and medicine.**] *Paris,* 1919, Masson et C$^{ie}$.

The pamphlet on anaesthesia by stovain (Billon), written by the veterinary surgeon, M. Gustave Perol, is of interest not only from the point of view of veterinary surgery, but also from that of experiments on animals it is of importance to surgeons in general. In veterinary surgery it should make general the practice of operating under anaesthesia ; there is no longer ground for the make-believe assertion that animals feel little pain. One of the dangers of local anaesthesia is the possibility of poisoning by cocain. Stovain proves a safe and yet an efficient drug for animals.

General anaesthesia has not come to be regularly used in veterinary surgery, for large animals, especially horses, are particularly susceptible to chloroform and ether, so that the administration, to be safe, requires much skill and experience. This necessitates the attendance of two veterinary surgeons at the operation. The animals recover but slowly; they are unable to stand for some hours, and meanwhile there is much risk, in their attempts to rise, from falls to the ground or against the wall of the stable.

The animal must be thrown, for which the help of eight men is desirable, besides the apparatus and bedding. The animal must be kept without food for 24 hours, for a distended stomach has been ruptured when the horse has been thrown, even upon a thick layer of straw. Also, as the animal's four legs are drawn together in struggling, it arches its back, and this has been sufficient to produce a fracture of the spine in the lumbar region, and the animal has never got up again.

Operations without anaesthesia cause shock as a result of the pain, and nervous horses will show this by appearing fatigued, bathed in sweat, and trembling, from which it takes hours to recover. Moreover, the pain continues after the operation. When being redressed, the animal is in fear of pain and resists violently, which itself has occasioned various accidents, and such horses afterwards become difficult to shoe.

Local and regional anaesthesia by stovain saves pain, the animals stand still, even without a twitch on the nostril; they will chew hay whilst an operation is being performed, and subsequently they do not resist manipulations and re-dressings.

For the veterinary operator the position of the horse standing is much more convenient than when lying on the side. The foot can be held raised, as when shoeing; the hoof may rest on a stool when carious bone is being gouged away.

General anaesthesia can only be used conveniently on smaller animals, cats and dogs, and then only by those who have special experience.

Stovain is a safer drug than cocain for horses. After the injection of 0·5 gm. of cocain a horse may show nervous excitement, tremors, and profuse sweats, whereas no harm follows from a dose of 2 gm. of stovain. The apparatus is simple and easily carried about. Two syringes of 10 c.cm. and 20 c.cm., ampoules of stovain—adrenalin solution, and boiled water are the requisites. The injection can be made by the operator 20–30 minutes beforehand.

For the diagnosis of lameness a 3 per cent. solution of stovain is used. Two injections of 5 c.cm. each, made into the plantar nerves on either side behind and just above the fetlock joint, cause lameness beyond in the hoof to disappear. Two injections of 5 c.cm. each made into the plantar nerves on either side of the upper part of the cannon bone causes lameness in the fetlock joint and beyond to disappear. An injection of 10 c.cm. into the course of the median alongside of the upper part of the radius and into the tibial nerve below the hock abolishes lameness below, as also 10 c.cm. injected into the median in the upper part of the arm near the scapula and into the sciatic in the thigh. The points for these injections are shown in photographs in the pamphlet. The total amount of stovain injected for the diagnosis of lameness is 40 c.cm. of a 3 per cent. solution, i. e. 1·2 gm. of stovain.

Before operating, similar quantities of a 5 per cent. solution are injected; for operations on the hoof 5 c.cm. into each plantar nerve above the fetlock; for operations on the fetlock joint and its neighbourhood 5 c.cm. on each side of the upper part of the cannon bone; 10 c.cm. into the median or tibial nerve in the forearm or leg; 10 c.cm. into median or sciatic in the arm or thigh. Anaesthesia occurs in 20–30 minutes, when a tourniquet can be applied and the operation carried out without the animal feeling anything. After the operation the dose can be repeated and further doses on subsequent days to prevent pain.

For local anaesthesia a 2 per cent. solution of stovain may be used, to which may be added for every 5 c.cm. one drop of adrenalin, 1 in 1,000. The local anaesthesia is produced by injecting the area to be operated upon; by it operations can be performed on small animals, cats and dogs. A dog weighing 30 kilos can be given safely a dose of 15 c.cm., i. e. 0·3 gm. of stovain, or 1 centigram per 1 kilo.

For large animals, 80 to 100 c.cm. can be used, i. e. a dose up to 2 gm. of stovain for a horse. W. G. S.

**Dandy, W. E. Experimental hydrocephalus.** *Ann. Surg.*, 1919, **70**, 129.

In this paper Dandy describes the experiments in the artificial production of hydrocephalus in animals. They will be found of great interest and materially confirm the essentially obstructive nature of hydrocephalus in all its forms, including the variety heretofore known as ‘idiopathic’.

The experiments are well summarized under the following headings:

1. Hydrocephalus produced by placing an obstruction in the aqueduct of Sylvius. The cerebellum is raised, the roof of the fourth ventricle perforated, and a pledget of cotton glided into the aqueduct at the end of a carrier. An improved technique consists in the use of an oiled gelatine capsule to enclose the cotton. This envelope is rapidly dissolved by the

cerebrospinal fluid. One month later the animal is killed, and at autopsy the ventricular system anterior to the obstruction found greatly dilated. Dandy believes this experiment to prove definitively that (*a*) the cerebrospinal fluid forms in the ventricles; (*b*) the production of this fluid in the ventricles is at least greater than its absorption; (*c*) the aqueduct of Sylvius is a necessary outlet from the third and lateral ventricles; (*d*) there are no collateral channels to take the place of the occluded iter.

2. Unilateral hydrocephalus produced by occluding one foramen of Monro. A transcortical incision gives access to the lateral ventricle, the foramen being then blocked by a piece of fascia or peritoneum. Unilateral hydrocephalus develops, the opposite ventricle remaining normal. Dandy records the fact that the cortical incision invariably closes spontaneously, although the pressure within the ventricle is raised by the foraminal occlusion; a point of interest in connexion with the utility of callosal puncture for the cure of hydrocephalus.

3. Removal of the choroid plexus and occlusion of the foramen of Monro. The result of this interesting experiment is the obliteration of the affected ventricle. This is in marked contrast to the ventricle of the opposite side where, if the foramen of Monro is blocked without plexectomy, a unilateral hydrocephalus results, as in experiment 2. Dandy emphasizes the fact that these experiments are the only absolute proof that the cerebrospinal fluid is formed by the choroid plexus, and that the ependyma plays no part in its elaboration.

4. Extirpation of the choroid plexus of both ventricles, followed by occlusion of the aqueduct of Sylvius. Hydrocephalus follows this operation, but the dilatation of the lateral and third ventricles is not so severe as that which follows the plugging of the iter without plexectomy. The cerebrospinal fluid contained in the ventricles has been formed from the choroid plexus of the third ventricle, and it has so far been found a technical impossibility to remove this.

5. Hydrocephalus following ligature of the vena magna Galeni. Dandy gives a brief sketch of the clinical evidence supporting the view that hydrocephalus results, or may result, from obstruction of this vein. His experiments show that the point of obstruction is of paramount importance, and that if a ligature is applied at the anterior end of the vein hydrocephalus follows. When ligatured further back a collateral circulation comes into play, and the choroid plexuses are relieved of the venous congestion and consequent over-production of cerebrospinal fluid which is the essential feature of this variety of hydrocephalus.

6. Channels for the circulation of the cerebrospinal fluid in the subarachnoid space. Dandy has conducted some experiments with Indian ink to show the main pathways in the subarachnoid space, followed by the cerebrospinal fluid after its escape from the fourth ventricle foramina. This part is an essential step towards the understanding of what is perhaps Dandy's most important finding, namely, the fundamentally obstructive nature of 'idiopathic' hydrocephalus. He finds that the basal cisternae rapidly fill with ink granules when the cerebrospinal fluid is replaced by an Indian-ink solution, and that these granules follow the sulci all over both surfaces of the hemispheres (resembling the distribution of the pus in meningitis). Dandy points out that all the fluid formed by the choroid plexuses has to reach the supratentorial chamber by passing up between mid-brain and the tentorium cerebelli. This passage is a straight one and

readily blocked by adhesions, which are torn through and generally neglected if the brain is removed in the usual manner, i.e. by enucleation from the dura, instead of being removed intact within its dural envelope; a post-mortem manœuvre only too rare. Adhesions about the mid-brain occluding the passage through the opening of the tentorium cerebelli he believes to be the true pathological anatomy of 'idiopathic' hydrocephalus. Here the exits from the fourth ventricle into the basal cisterns are widely opened, drugs such as phenolsulphonephthalein injected into the lateral ventricles are easily and rapidly recovered from the cerebrospinal fluid of the spinal theca, and yet hydrocephalus exists because this fluid is prevented by the mid-brain adhesions from reaching the supratentorial chamber, where at least 80 per cent. of its absorption takes place. This very reasonable explanation, reasonable because it places all forms of hydrocephalus on the same basis, Dandy has been able to substantiate by experiment. By encircling the mid-brain with a tiny piece of gauze saturated with an irritant (iodine, he finds, is an infallible producer of adhesions) he has been able to produce a circle of adhesions about the mid-brain and margins of the incisura tentorii. This adhesion he graphically demonstrated by substituting Indian ink for cerebrospinal fluid some two hours before the death of the animal. The ink granules are distributed through every part of the subarachnoid space open to the cerebrospinal fluid, but the ink does not pass beyond the perimesencephalic obstruction, a point clearly shown in his illustrations. The experiments were conducted upon dogs, but Dandy gives no information as to the number of the experiments in each class, nor as to the operative mortality. These omissions somewhat vitiate what is otherwise a most interesting and valuable contribution. G. J.

**Söderbergh, G.** Zona intercostal et symptômes moteurs du côté de l'abdomen. [**Herpes zoster and motor symptoms of the abdominal wall.**] *Acta med. Scandinav.*, 1919, **102**, 225.

Söderbergh describes a case of herpes zoster, in which the vesicles were localized in front of the nipple-line in the distribution of the left fifth and sixth thoracic roots. In the area of the latter root he found a hypalgesia, all other forms of sensation being normal. When the patient coughed or spoke, the median line above the umbilicus deviated to the right. The abdominal reflexes were intact and motility was otherwise normal. At the end of two weeks the deviation could no longer be observed with certainty. Söderbergh concludes that there was an inflammatory lesion in the corresponding posterior root ganglia on the left side, and this had spread into the surrounding tissues and involved the anterior roots. The result of this was a slight paresis of the left external oblique. He considers that this case, therefore, is an example of the importance of the 'superior abdominal syndrome' as an aid to finer diagnosis. G. J.

**Söderbergh, G.** Une nouvelle contribution à l'étude des syndrômes radiculaires moteurs de l'abdomen. [**A new contribution to the study of the motor root syndromes of the abdomen.**] *Acta med. Scandinav.*, 1919, **102**, 211.

Söderbergh has interested himself in the segmental innervation of the abdominal musculature, and within recent years has published several papers on this subject. A bibliography of these writings will be found in the article above named. He has on two occasions practised a stimulation of the motor roots during the course of spinal operations. In the first case he stimulated the sixth thoracic anterior root, and found that contraction of the two upper segments of the rectus abdominis of the same side resulted, whilst excitation of the seventh led to contraction of the three highest segments of the rectus and of the upper part of the oblique musculature as well. In a second case he stimulated the eighth thoracic. With a very feeble current a band of the external oblique, some 3–4 cms. long, running from the lower costal margin towards the umbilicus was thrown into contraction. With a stronger current this band became more marked, displacing the umbilicus laterally and superiorly, with strong contraction of the part of the rectus abdominis above the umbilicus (i. e. its upper three segments). These observations enabled him to make a very accurate diagnosis of the level of a spinal tumour in the case which is the subject of the present memoir.

A man of 29 began to suffer from sharp root pains in the lower thoracic region in August 1917. The pain was at first localized to the right side, but later spread to the left at the same level. When seen in September 1918, he was hypo-aesthetic to all forms of sensation as high as the distribution of the ninth thoracic, and had a spastic paraplegia of moderate degree. He could walk with difficulty, the right leg being weaker than the left. There was some trouble with micturition and defaecation. The abdominal signs were very interesting. Whilst at rest no abnormalities of the muscles of the abdomen were discernible, but the patient was liable to sudden attacks of very severe intercostal neuralgia on the right side, and, during these, localized cramps of the muscles could be clearly seen. As these attacks of pain could be brought on at will, especially by turning the head to the left, Söderbergh was afforded full opportunity of accurately delimiting the muscles involved. He found that a clonic contraction of the part of the rectus above the umbilicus occurred during the seizures, with displacement of the umbilicus itself upwards and towards the same side (the right). He considered that the muscular cramps perfectly corresponded with those seen on electrical stimulation of the seventh and eighth thoracic motor roots, and diagnosed a spinal tumour at that level, although the sensory signs pointed to a tumour at a level no higher than the ninth dorsal. Before a laminectomy could be performed the patient died from influenzal pneumonia. At the autopsy, the diagnosis was confirmed, for a tumour was found on the right posterior aspect of the spinal cord with the seventh thoracic sensory root stretched over it behind and the motor root in contact with it in front. Söderbergh contends that it was only by knowing the innervation of the abdominal musculature that it was possible accurately to localize this tumour, and records it as an interesting example of an irritative root lesion.

G. J.

**JEFFERSON, G. Gunshot wounds of the scalp, with special reference to the neurological signs presented.** *Brain*, 1919, **42**, 93.

Jefferson records the clinical histories and neurological signs presented in a series of 54 unselected scalp wounds, the result of gunshot injuries. In none of these cases was a fracture found either at operation or by X-ray, nevertheless signs and symptoms of intracranial disturbance were present in all but five. This emphasizes the well-known resilience of the cranial capsule, which allows of distortion to a degree sufficient to injure the subjacent brain, without serious injury to the calvarium resulting from the blow.

He divides the cases into two classes, the first being those with signs of a general or concussional nature; the second those in which a local cerebral contusion can be detected as well. It is notoriously difficult to establish a diagnosis when the wound overlies a silent area, but some 44 per cent. of this series gave evidence of injury in a localized area.

Of the general signs observed, headache was the most frequent. In 45 per cent. of cases it was 'fixed', severest in the region underlying the wound, but it usually resolved itself into frontal headache, worst in the evenings. Nausea and vomiting occurred in a certain number, but next to headache increase in the tendon-jerks was the most common sign; the arm was less often affected in this way than the leg, and only in the severer cases. A few beats of ankle clonus present on one side only may be a valuable sign.

A series of thirteen contusions of the motor cortex are analyzed. These are interesting, because only in non-penetrating wounds such as these can one be sure that he is dealing with an injury limited to the cortex itself without disruption of sub-cortical fibres. The fact that most of the localizing signs rapidly cleared up without leaving any residual palsy or anaesthesia seems to show that the pathological anatomy of these contusional cases is little more than a cortico-meningeal haemorrhage, although it is recognized that a superficial disorganization of brain substance may occur beneath the intact skull. The common motor syndrome was a face-hand palsy, the elbow and shoulder being spared. When the wound was on the left side a motor aphasia was added. Two interesting examples of contusion of the parietal field, with pseudo-radicular anaesthesia of the hand and forearm, are described. Three cases presented Jacksonian fits; in one an extradural clot was found, the calvarium being uninjured, the other two were controlled by lumbar puncture and large doses of bromide. This latter conservative treatment gives good results. Reference is made to the protracted nature of some of the fits seen in head injuries, and the relationship of Kozhevnikov's syndrome. Contra-lateral motor injury was noted four times.

Of four cases of contusion of the visual cortex only one had a persistent scotoma. Injuries of the area striata provide an admirable field for the observation of the daily recovery from the contusion. At the end of a week or ten days nothing may remain of what was at one time a definite clinical entity.

Jefferson concludes that cerebral injury in the so-called 'simple' scalp wounds is far commoner than is generally believed. Careful neurological examinations are rarely carried out on these cases, and the brain injury is usually overlooked. There is a moral to be drawn from these findings with regard to the assessment of pensions, for whilst the injury to the hairy scalp may have been in itself a trivial thing, the brain may have suffered an injury of no little moment, and this possibility should be given full consideration in the medical boarding of such subjects. G. J.

## NEUROLOGY

**Roussy, G.** et **Cornil, L.** Monoplégie brachiale sensitive avec ataxie, léger tremblement et attitudes athétosiques consécutives à des injections de vaccin antityphique. [**Sensory brachial monoplegia following antityphoid inoculation.**] *Rev. neurol.*, 1919, **5**, 453.

**Roussy, G.** Un cas d'hémiplégie droite avec aphasie consécutif à une injection antityphique. [**Hemiplegia with aphasia after antityphoid inoculation.**] *Rev. neurol.*, 1919, **6**, 505.

**Souques, A.** Syndromes nerveux consécutifs à la vaccination antityphoïdique. [**Nervous symptoms after antityphoid inoculation.**] *Rev. neurol.*, 1919, **6**, 501.

**Guillain, G.** et **Barre, J. A.** Paralysie ascendante aiguë de Landry consécutive à une vaccination antityphoïdique. [**Landry's paralysis after antityphoid inoculation.**] *Rev. neurol.*, 1919, **7**, 595.

In these papers, several cases of nervous complications of antityphoid inoculation are described, while others are referred to in the discussion following the presentation of the papers quoted above at the Neurological Society of Paris.

In nearly all, the vaccine used was a 'T. A. B.' vaccine, either 'étheré' or 'chauffé', in doses of 1 or 2 c.c. The nervous sequelae commonly followed the second or third injection and made their appearance within a few hours and quite abruptly.

Both Roussy's cases presented signs of cortical lesion, thrombosis, or embolism, probably the former. The first was a monoplegia of the left arm, appearing without any meningeal symptoms, or any disturbance of consciousness, on the day after a third injection of T. A. B.

Examination revealed a purely sensory disturbance of cortical type, corresponding exactly to the description of cortical lesions given by Head and Holmes. There was no true loss of power, but a slight atrophy developed during the weeks following the onset. Improvement was gradual.

The second case followed a first injection of the same vaccine. Eight hours after the inoculation the patient fell suddenly unconscious. Next day there were complete right hemiplegia with total aphasia and signs of meningeal reaction. Six months later a typical residual hemiplegia with spasticity and gross dysarthria were found. At the onset the C.-S. fluid presented a lymphocytosis, but was otherwise normal.

The seven cases recorded by Souques are as follows:

1. Sudden onset of right hemiplegia and aphasia, with loss of consciousness, several hours after a second injection of an antiparatyphoid *A* and *B* vaccine. A residual hemiplegia with dysarthria was found 18 months later.
2. Acute onset of headache, fever, and vomiting four hours after a fourth injection of antityphoid vaccine. A residual unilateral cerebellar disturbance remained a year later.
3. Immediate onset of headache and other meningeal symptoms after a fourth injection of T. A. B. The recorded diagnosis on admission to hospital was 'état méningé, choc vaccinal avec azotémie'. Eight months later, no objective signs of nervous lesion were found, but the patient complained of constant headache, and was altered in his disposition, being very irascible and indifferent to the conduct of his affairs.

4. A series of apparently genuine epileptic fits followed rapidly a second T. A. B. injection in a previously healthy man.

5. ‘Réaction méningé’ immediately after first injection of T. A. B. (1 c.c.). Four months later constant headache, no objective signs, but a lymphocytosis in the C.-S. fluid.

6. After a single injection of an unspecified antityphoid vaccine, there developed severe headache and vomiting. Paroxysms of headache and vomiting persisted for a month, when they cleared up.

7. Fever lasting for several days followed a third injection of a T. A. B. vaccine. Four months later the patient began to complain of prominence of his eyes and of tremor. Examination at this date revealed a well-developed case of Graves's disease.

Souques offers no explanation of these sequelae, which he does not consider are in any way to be regarded as a contra-indication to the continued use of antityphoid inoculation.

In recording a fatal case of acute ascending Landry's paralysis, Guillain and Barré also agree as to the value of this measure.

The patient, a healthy man of 31, had already received, in 1915, three injections of an antityphoid vaccine without untoward result. In August 1916 he received $1\frac{1}{2}$ c.c. of ‘vaccin T. A. B. à l'éther’. That night he had a certain degree of malaise, and next morning found his legs heavy and stiff. On the following day these symptoms were more severe and had appeared in his hands. On the third day he was unable to whistle. He was at this stage admitted to hospital. The legs were very weak, the trunk muscles also affected, but the arms very slightly weak. The cranial nerves were normal. The tendon-jerks were absent, the plantars unobtainable. There was an appreciable impairment of cutaneous sensibility in the feet, but no other objective sensory loss. The sphincters were normal. The cerebrospinal fluid showed a lymphocytosis and an increase of albumin, but was sterile. Progressive involvement of the respiratory and the bulbar mechanisms resulted in death nine days after inoculation.

In a discussion on Souques's observations, Sicard also recorded several similar cases of reaction to inoculation. In these the injection was made in the region of the scapula, was followed by some local oedema and by moderate fever. A paresis of the corresponding arm then remained for several weeks. He regarded this as due to a local toxic action (‘une impregnation toxique’) on the brachial plexus or its roots. F. M. R. W.

**Marinesco, G.** Étude sur l'origine et la nature de la sclérose en plaques. [**On the origin and nature of disseminated sclerosis.**] *Rev. neurol.*, 1919, **6**, 481.

The view originally put forward by Pierre Marie many years ago, that disseminated sclerosis is an inflammatory process of infective origin has been borne out by recent research. The essential lesion of the disease is a small focus of inflammation, which may be found in any part of the central nervous system, and consists of the infiltration of the adventitial sheath and perivascular tissue of a small vein by small round cells, polyblasts, plasma cells, and mast cells. Polynuclear leucocytes are rare.

There are multiple lesions of this kind along the course of small veins, and changes in the nervous and supporting tissues are secondary to this fundamental lesion. A proliferation of glia cells accompanies this perivascular process, and when a plaque involves the cerebral cortex or the optic nerves, giant cells develop.

The progress of the disease is consistent with the spread of an organism along the perivascular lymphatics. We know of no poison that is capable of producing such lesions, while the acute attacks, the remissions and exacerbations of disseminated sclerosis accord with an infective origin, presumably infection by a specific organism.

In 1917, Kuhn and Steiner inoculated guinea-pigs with the blood and cerebrospinal fluid of patients with disseminated sclerosis, and were able to demonstrate the presence of a spirochaete in these animals. The injections were intraperitoneal, and in several injected animals motor disturbances in the limbs developed after an interval of three days. With rabbits similar results were obtained, and the spirochaete found resembled that associated with icterus haemorrhagicus.

Simon repeated the experiments using rabbits, and, injecting cerebrospinal fluid from cases of disseminated sclerosis sub-durally into his animals, observed fatal paralytic sequelae.

Siemerling (1918) recorded the presence of spirochaetes, under the ultramicroscope, in the brains of patients with the disease.

During the present year, Marinesco injected the cerebrospinal fluid of two patients into six guinea-pigs, using the intracerebral, intraspinal, and intraperitoneal routes in different animals. The two animals injected intracerebrally showed a few days later paresis of the hind limbs. Their cerebrospinal fluid, obtained from the fourth ventricle, contained numerous spirochaetes, corresponding with those described by Kuhn and Steiner. Roux, who saw these organisms, agreed that they were specific and differed from the *Treponema pallidum* of syphilis. Subsequent inoculation of fresh guinea-pigs from the same patients gave negative results, which Marinesco ascribes to the more advanced and probably less infective stage of the disease.

In conclusion, it is claimed that these observations indicate the existence of a specific virus, a spirochaete, in disseminated sclerosis, which is the cause of the disease in man, and which can be transmitted to animals, in whom it produces paralytic phenomena. F. M. R. W.

**Kalberlah, F.** Die Behandlung der multiplen Sklerose mit Silbersalvarsan Natrium. [**Treatment of multiple sclerosis with sodium-silver-salvarsan.**] *Med. Klin.*, 1919, **15**, 792–4.

Kalberlah has treated numerous cases of disseminated sclerosis by intravenous injections of this preparation in doses of from 0·1–0·15 grm. in 10 c.c. of water. (For technique of injection see *Med. Science,* 1919, **1**, 338.)

In early cases, this was followed by the disappearance or marked improvement of both motor and sensory symptoms. On the other hand, sphincter defects and changes in the reflexes remained unaltered. Long-standing cases and those with optic atrophy, psychical and speech disturbances were unaffected.

Kalberlah admits the difficulties of determining the effects of treatment in a disease so prone to remissions and variations as disseminated sclerosis.

In almost all cases the drug was well borne and the general condition was improved, probably as a result of arsenic medication. He concludes by suggesting that if disseminated sclerosis prove ultimately to be a spirillosis, sodium-silver-salvarsan may be expected to be as specific for it as salvarsan is for syphilis. J. D. R.

**Marie, P.** et **Léri, A.** Oxycéphalie et syringomyélie : contribution à la pathogénie de certaines cavités médullaires. [**Oxycephaly and syringomyelia. The pathogenesis of medullary cavities.**] *Bull. et mém. Soc. méd. d. hôp. de Par.*, 1919, 3e sér., **43**, 762–3.

A man aged 30, the subject of oxycephaly, after an attack of 'influenza' at the age of 30, developed symptoms of syringomyelia, or at least hydromyelia, which was manifested by paralysis and bilateral amyotrophy of the muscles supplied by the ulnar nerve and by dissociated anaesthesia.

The writers suggest the possibility of a causal relation between the oxycephaly and the lesion in the spinal cord, and allude to other examples of syringomyelia and hydromyelia resulting from intra-cranial hypertension ; as in the cases of cerebral tumour reported by Langhans and other writers. In those cases, however, the hypertension was due to a new growth within the cranium and not to a deformity of the cranium itself as occurs in oxycephaly. The present case closely resembles a case of Paget's disease recently seen by the writers with a mushroom-like deformity of the skull in which a considerable degree of syringomyelia was found at the autopsy. J. D. R.

**Dejerine, Mme., Ceillier, A.,** and **Dejerine, Mlle.** Para-ostéo-arthropathies des paraplégiques par lésions médullaires. Étude anatomique et histologique. [**Para-osteo-arthropathies in spinal cord lesions : an anatomical and histological study.**] *Rev. Neurol.*, 1919, **5**, 399.

These bony new formations which are found in cases of complete and incomplete paraplegia from gunshot wound are classified as (1) true para-osteo-arthropathies, and (2) intramuscular ossifications.

*True para-osteo-arthropathies* are situated in the neighbourhood of joints, epiphyses, and the shafts of long bones. They vary in form and structure in each instance. Thus at the knee are found nodular masses of compact bone arising in the neighbourhood of the internal condyle. Arising separately, or sometimes from such a bony mass, is found in many instances a spongy growth of delicate foam-like structure which spreads up along the mesial surface of the shaft of the femur. This sends out at intervals fine processes which unite it to the shaft. Both the compact nodular and the spreading spongy formations may occur separately or together. They may be independent, or the latter may arise upon the former. It is a general rule that compact masses are found in connexion with the epiphyses and spongy ones along the shafts.

Equally characteristic are the new formations found in connexion with the pelvis. Here they form an 'ankylose cerclée', which extends like a collar from the pelvis round the acetabulum to the base of the neck of the femur. This structure is spongy except sometimes at its origin from the iliac fossa just above the anterior inferior iliac spine. It lies without the capsule of the joint. The joint is never involved or penetrated by osteophytic processes, and the articular surfaces are normal. This is also true in the case of the knee-joint.

These new formations never arise in connexion with the sites of old injuries to the bones.

*Intramuscular ossifications* have no connexion with the skeleton, but develop in the fibrous tissue of the muscle and its aponeurosis or tendon. The tensor fasciae latae and gluteus are favourite sites.

Histologically all the formations consist of fine trabeculae enclosing minute spaces. They are very vascular, show abundant osteoblasts and cartilage cells, and they are surrounded by dense fibrous tissue, which separates them from the muscle fibres.

They are of very frequent occurrence, being found in 48 per cent. of all post-mortems upon paraplegics. They do not occur below the knee or above the pelvis, nor do they deform the skeleton in any way.

The authors suggest, to account for their formation, that a metaplasia of primitive connective tissue has occurred under the influence of an abnormal irritability of the intermedio-lateral group of cells below the level of the cord lesion. Oedema, traction, and other mechanical factors may also play a part. F. M. R. W.

**Roger, H.** Les paralysies partielles de la paroi abdominale par lésion traumatique des nerfs intercostaux ou lombaires. [**Partial paralysis of the abdominal wall from a traumatic lesion of the intercostal or lumbar nerves.**] *Paris méd.*, 1919, ii, 239–43.

Although traumata involving the limbs have been the object of detailed study during the past few years, paralysis affecting the trunk and particularly the abdominal muscles has received but little attention. Associated injuries of the underlying viscera are so frequently fatal or productive of serious complications which dominate the clinical picture, that the paralysis of the abdominal wall escapes notice. This may be the reason why in such recent publications as those of Tinel and of Athanassio-Benisty no mention of such paralyses is made.

The cause is a wound of the postero-inferior part of the thorax with involvement of the lowest intercostal nerves and, generally, fracture of a rib, or a wound in the upper lumbar region involving the branches of the first lumbar root. Roger records a case in a soldier wounded by a rifle bullet, which entered by the anterior wall of the left axilla and came out through the posterior wall of the thorax, fracturing the 7th, 8th, and 9th ribs. A paresis of the left arm followed and lasted for two months, being probably due to compression of the brachial plexus by haemorrhage. An empyema which resulted also healed fairly rapidly. When seen a year after his wound, the patient presented a paralytic distension of the left upper part of the abdominal wall, due to section of the 7th, 8th, and 9th intercostal nerves, with corresponding sensory loss and abolition of the left epigastric and upper abdominal reflexes on that side. The paralysed muscles showed alterations of electrical reaction. J. D. R.

**Roussy, G.** et **Cornil, L.** Névrite hypertrophique progressive non familiale de l'adulte. [**Non-familial progressive hypertrophic neuritis in the adult.**] *Ann. de méd.*, 1919, **6**, 296–305.

Two forms of hypertrophic neuritis have hitherto been described; (1) The Dejerine-Sottas type, characterized by generalized muscular atrophy with fibrillation, ataxy, lightning pains, Rombergism, nystagmus, myosis, and the Argyll Robertson pupil, and such skeletal deformities as scoliosis and pes cavus. The onset is during infancy or adolescence, and the lesion is a neuritis chiefly involving the interstitial tissues and causing marked thickening of the nerve trunks.

(2) Pierre Marie-Boveri type, in which the muscular atrophy predominates in the lower limbs and there is kypho-scoliosis, intention tremor, scanning speech resembling that found in disseminated sclerosis and exophthalmos. Rombergism, ataxy, and lightning pains are absent. Both nerve fibres and interstitial tissues are affected, and Marie and Boveri suggest the name *familial* hypertrophic neuritis.

Roussy and Cornil now describe a third type, differing from type (1) by the late onset, by the absence of Argyll Robertson pupil, myosis, nystagmus, and generalized muscular atrophy, and by the occurrence of an intention tremor, and from type (2) by the absence of the familial incidence, exophthalmos, and speech disturbance, and by the presence of a muscular atrophy of Aran-Duchenne type. J. D. R.

**TOMASCHNY.** Der Bauchdeckenreflex in seiner Beziehung zum epileptischen Krampfanfall. [**The abdominal reflex in epilepsy.**] *Med. Klin.*, 1919, **15**, 639–40.

The author describes the frequent transient absence of the abdominal reflexes after an epileptic attack, a phenomenon perhaps not so widely known as its importance deserves. The abdominal reflex is a very constant phenomenon in health, except when certain abnormal local conditions of the abdominal wall, such as obesity or the changes resulting from numerous pregnancies, abolish or mask it.

Tomaschny finds that after an attack these reflexes may be absent on both sides for a period ranging from a quarter of an hour to as much as two hours. On the other hand, they may be abolished on one side of the abdominal wall only, or merely diminished on one or both sides. In the same individual such variations may be found after different attacks, and may depend upon the varying severity of these. He states that in some epileptics the abdominal reflexes are normally unequal on the two sides.

The extensor plantar response and absence of the abdominal reflexes indicate disturbed function of the pyramidal tract, but these two signs of this disturbance are not always associated; thus, the extensor response may be found with persistent abdominal reflexes, or, on the other hand, the latter may be abolished without the appearance of extensor responses.

It seems possible that these variations depend upon the fact that Tomaschny's observations were not always made immediately after the cessation of the actual convulsion. Usually, during the stage of flaccidity and unconsciousness which terminates a fit, the abdominal reflexes are absent, as are the tendon-jerks and the pupillary reactions, while the extensor response is to be obtained on both sides. Normal reflex responses in respect of all these are rapidly restored, and it is possible that the order of this restoration to normal may vary in different cases and after different attacks.

The significant and valuable point is that during the later stages of a convulsive attack, or immediately after its cessation, there may be present certain alterations of the reflexes of which absence of the abdominals and the presence of extensor responses are commonly found. When this is so, we have a most valuable means of differentiating a true epileptic from a hysterical attack—often a matter of considerable difficulty unless the onset of the attack and its complete course have been observed. On the other hand, the absence of these reflex alterations has no distinguishing value if only looked for after the attack is over. J. D. R.

**Duschak, E.** Zur konservativen Behandlung der Epilepsie. [**Conservative treatment of epilepsy.**] *Wien. med. Wchnschr.*, 1919, **69**, 882–3.

The occurrence of epileptic symptoms has become considerably more frequent since the war. Quite apart from gross injuries of the skull, contusions, being buried, and even injuries to the extremities may be followed by attacks which may be regarded as epileptic. Lastly, a latent epilepsy may be roused into activity as the result of the hardships of war. Operation is indicated in only a few cases, so that a wide field is open to conservative treatment. Inspired by the work of Meltzer and Auer, who have shown that magnesium ions have a restraining influence on all parts of the nervous system, Duschak has treated 10 cases of epilepsy by subcutaneous injection of a 5 per cent. solution of magnesium sulphate. Stronger solutions give rise to symptoms of irritation at the injection site and were not employed. The injections were given in daily doses of 15–20 cc. in the gluteal region, thigh or chest, and continued for weeks or months. In each case a diminution and frequently an arrest of the attack took place. The injections were painless, and no complications of any kind were observed, such as renal irritation. Duschak recommended that even after cessation of the attacks prophylactic injections should be given every week.

J. D. R.

**Cazamian, P.** De mal de mer. Étude clinique, pathogénique et thérapeutique. [**Clinical symptoms, pathogenesis and treatment of sea-sickness.**] *Bull. et mém. Soc. méd. d. hôp. de Par.*, 1919, 3e sér., **43**, 638–41.

Cazamian, who is chief medical officer on the cruiser *Jean Bart*, has made a systematic study of 50 cases of sea sickness in the course of 2 years, with the following results. During the vomiting stage, the pulse is not slow, as stated in the text-books, but quickened in the great majority of cases, and there is an almost constant rise of blood-pressure. The oculo-cardiac reflex is inverted in most cases, and the pupils are more frequently dilated than contracted. All these symptoms indicate a hyperexcitable condition of the sympathetic. There appears to be a temporary excess of suprarenal activity instead of an acute reflex suprarenal insufficiency as described by Naamé, and it is only at an advanced stage that the cortical layer becomes incompetent and sympathetic deficiency occurs, as shown by a fall of blood-pressure. In the early stage Cazamian has obtained excellent results by subcutaneous injection of ·1 to 2 mgm. of atropine sulphate. Adrenalin is contra-indicated until the late stage, when symptoms of suprarenal insufficiency appear. Adrenalin should then be given by mouth (6 mgm. in 3 doses at half-hourly intervals). J. D. R.

**Wegeforth, P.** and **Latham, J. R.** **Lumbar puncture as a factor in the causation of meningitis.** *Am. J. M. Sc.*, 1919, **158**, 183–202.

Wegeforth and Latham point out that infections of the meninges occur not infrequently after removal of normal spinal fluid by lumbar puncture during a septicaemia. They record 5 personal cases and quote similar examples from the literature. A close analogy exists between these cases and certain experimental observations in which removal of cerebrospinal fluid during artificial septicaemia in animals is followed by the localization of the infection within the meninges. To prevent the accidental production of meningits as a result of diagnostic lumbar puncture, the writers recommend (1) that a careful bacteriological study of the blood should be made before such punctures are attempted; (2) that in acute diseases, in the absence of definite signs of irritation of the central nervous system, lumbar puncture should be avoided, unless it is first conclusively shown that the blood is free from infection; (3) that when the clinical symptoms are such as to render lumbar puncture advisable, minimal quantities of fluid should be withdrawn, sufficient only to permit necessary laboratory tests to be made; (4) small bore needles should be used to prevent as much as possible subsequent leakage of spinal fluid into the surrounding tissues. J. D. R.

**Bonnamour, S.** et **Macrygenis, A.** Méningite pneumococcique consécutive à une contusion du crâne sans fracture. [**Pneumococcal meningitis following contusion of the skull without fracture.**] *Lyon méd.*, 1919, **128**, 321–5.

A record of a fulminating case of acute pneumococcal meningitis in a man aged 28 following a fall from a scaffold. Meningitis developed the day after the accident and proved fatal in 4 days. No other localization of the pneumococcus was found at the autopsy. Similar cases were reported by Chalier, Nové-Jusserand, and Mazel in 1912, and by Oettinger in 1918, who suggested that as the pneumococcus was an ordinary inhabitant of the nasal or nasopharyngeal cavities, meningitis due to a violent injury without external wound was more likely to be pneumococcal than of any other nature. J. D. R.

**Sieben.** Raynaudsche Krankheit und Hysterie. [**Raynaud's disease and hysteria.**] *Med. Klin.*, 1919, **15**, 712–13.

Sieben records a case of auto-mutilation in a hysterical girl, aged 19, who had successfully simulated Raynaud's disease for several years by tying twine steeped in pure carbolic tightly round her fingers and toes. When seen by Sieben she had lost all her toes, the 3rd, 4th, and 5th fingers of the right hand, and all the fingers of the left hand, except the index and first phalanx of the middle finger. A scar on the chest was also due to gangrene, caused by application of carbolic. The chief distinction between her condition and Raynaud's disease was the fact that the ischaemia was not followed by cyanosis, but was immediately succeeded by necrosis.

J. D. R.

**D'Oelsnitz** et **Cornil, L.** Syndrome d'hémiatrophie gauche totale post-traumatique progressive. [**Complex and progressive post-traumatic left hemiatrophy.**] *Bull. et mém. Soc. méd. d. hôp. de Par.*, 1919, 3e sér., **43**, 634–6.

A man aged 32, after a violent fall on his left side from a motor cycle, suffered for two months from severe pain in the left shoulder and hip. The pain then disappeared, but returned in the 4th month, when a complete and progressive atrophy of the left upper and lower limbs developed. The pain ceased about the 6th month, when a rapid and painless atrophy of the left side of the face and tongue occurred. When seen 13 months after the onset of the symptoms there were no fibrillary tremors, nor change in the electrical reactions in the atrophied muscles. Sensibility was normal, except in the area of the left fifth nerve, where there was a slight hyperaesthesia to touch and pin prick. There was no syringomyelic dissociation, and the reflexes and cerebrospinal fluid were normal. The pathogenesis of the case was obscure. Progressive myopathy of traumatic origin was excluded by the hemiplegic distribution and involvement of the left half of the tongue and palate. Post-traumatic syringomyelia was negatived by normal sensibility, hemiplegic distribution, absence of radicular systematization in the atrophy, and the normal character of the electrical reactions.

J. D. R.

**Marie, P., Chatelin,** and **Bouttier, H.** Forme hémiplégique de sclérose latérale amyotrophique. [**A hemiplegic form of amyotrophic lateral sclerosis.**] *Bull. et mém. Soc. méd. d. hôp. de Par.*, 1919, 3e sér., **43**, 925–30.

A record of a case of amyotrophic lateral sclerosis which had reached the bulbar stage and in which the motor symptoms were so predominant on the right side of the body that it might have been mistaken for a case of hemiplegia. A hemiplegic distribution at the onset of amyotrophic lateral sclerosis is recorded, but a unilateral predominance of symptoms throughout the course of the disease, as in the present case, is exceptional. As a rule the amyotrophy becomes generalized much sooner and runs its course in a more symmetrical manner. To exclude the possibility of the condition being due to the supervention of hemiplegia in the course of lateral sclerosis, an electrical examination was made of the muscles on the hemiplegic side and definite changes of reaction found. J. D. R.

**Imbert, C. J. H.** Intégrité et altération des polynucléaires neutrophiles des liquides céphalorachidiens troubles. [**The condition of the polymorphonuclear leucocytes in turbid cerebrospinal fluid.**] *Thèses de Paris*, 1918–19, **178.**

As Widal and his pupils, Lemierre and Boidin, have shown, the state of the polymorphonuclear leucocytes is a valuable guide to the differentiation of septic and aseptic meningeal effusions. Alterations in these cells indicate an infected fluid, even when for technical reasons, or because they are scarce or of feeble vitality, the organisms in question cannot be found. On the other hand, when these cells are of normal appearance the fluid is usually sterile. However, in early lumbar puncture in acute infective meningitis, unaltered cells may be seen although the fluid contains organisms, while in long-standing cases with a sterile fluid the polymorphonuclears may show necrotic changes.

The rule is that in infected fluids these cell changes are early, while in sterile fluids the polymorphonuclear leucocytes disappear soon, to be replaced by mononuclear cells and lymphocytes. Therefore, careful cytological examination of a turbid cerebrospinal fluid is essential to confirm a positive bacteriological finding, and to control a negative result. J. D. R.

**von Economo, C.** Grippe-Enzephalitis und Encephalitis lethargica. [**Influenzal encephalitis and lethargic encephalitis.**] *Wien. klin. Wchnschr.*, 1919, **32**, 393–6.

According to Economo, lethargic encephalitis is an independent and distinct entity, clinically, anatomically, and experimentally. The symptoms of cerebral irritation observed in influenza and usually described as an encephalitis do not represent a separate disease nor even a true encephalitis. They may be toxic in origin, or due to metastatic processes of embolic origin. Only a very small number of cases showing signs of cerebral or spinal involvement can be regarded as encephalitis or myelitis respectively,

J. D. R.

**Abrahamson, I. Epidemic encephalitis (lethargic encephalitis). Preliminary report of the committee.** *N. York M. J.*, 1919, **110**, 17–19.

It is stated than an important difference between the epidemic in the United States and those in Europe is that in America lymphocytosis has been very common, and not exceptional as in the latter instances. Abrahamson prefers the term 'epidemic polioencephalitis' because the essential lesion involves the nuclei of the brain. He suggests that the term 'lethargic' should be dropped because the encephalitis itself is not lethargic, but is a very active process subject to exacerbations and remissions within a short space of time. Lethargy is not found in the majority of cases, while many patients show mental excitement and confusional states and many suffer from sleeplessness. To lay stress on lethargy may cause many cases to be overlooked by general practitioners, especially sporadic cases.

The mortality was 10 per cent. in his series, while complete recovery was only seen in 20 per cent. The rest were still progressing towards recovery.

J. D. R.

**Kickhefel, G.** Lähmung des weichen Gaumens nach Grippe. [**Paralysis of the soft palate following influenza.**] *Berl. klin. Wchnschr.*, 1919, **41**, 967.

In the Berlin University Clinic for disorders of speech, Kickhefel observed four cases of influenza, in whom paralysis of the soft palate occurred as a complication. He was unable to find any previous record of this in the literature.

Clinically, the influenza was in every way typical. There was fever, with catarrh of the respiratory passages. The patients complained of pains in the limbs and in the eyes, and profound fatigue. There was no membrane in the fauces, no enlargement of the cervical glands, nor any pain in swallowing. Diphtheria was therefore excluded clinically, though there is no mention of examination of throat swabs.

In no instance was the paralysis complete, some movement was always retained on phonation, and in only one case was there regurgitation of fluids through the nose. The most striking symptom appears to have been the nasal quality of the voice. No other nervous symptoms are recorded.

In some (number not stated) recovery occurred, but in the rest the defect persisted, and was possibly a functional perpetuation of an organic paralysis. The period of the illness at which this complication appeared is not given.

In connexion with these cases, the one reported by Oppenheim (vide *Medical Science*, 1919, **2**, 219) of faucial erysipelas followed by the clinical picture of diphtheritic paralysis is of interest. The present series supports the view expressed by Oppenheim that this clinical picture cannot be accepted by itself as evidence of diphtheria.

F. M. R. W.

**Gruber, G. B.** and **Lanz, H. F.** Ischämische Herzmuskelnekrose bei einem Epileptiker nach Tod im Anfall. [**Ischaemic necrosis of the heart muscle in an epileptic who died in a fit.**] *Arch. f. Psychiat. u. Nervenheilk.*, 1919, **61**, 98.

An apparently healthy young gunner of 29, was found unconscious in a latrine. On admission to hospital he gave a history of fits during the previous few weeks. Examination was negative, the vascular and nervous systems being normal. A fortnight later, he complained during the morning of headache and a sense of oppression in the chest. A fit followed almost at once. He became unconscious and cyanosed, and his pupils were fixed. The heart became irregular, and the pulse imperceptible. He was given injections of camphorated oil and of caffeine, but with no effect, and six minutes after the onset of the attack respiration ceased.

After death the brain, lungs, and abdominal viscera appeared normal. The heart was of normal size, and its valves were healthy in appearance. On the anterior aspect of the left ventricle and just to the left of the interventricular septum the muscle was of a grey streaky appearance. This area was sharply marked off from the normal muscle. Its surface was somewhat sunken below the general level, and on section the affected area looked grey, dry, and thinned. An irregularly narrow zone of dark bloodstained muscle substance separated the normal from the abnormal tissue. Microscopically the pale muscle was bloodless, its nuclei did not stain well, and it was surrounded by a narrow zone of engorgement, beneath which was another of leucocytosis.

The coronary vessels were normal and patent.

In explanation the authors suggest that the vasomotor aura of epilepsy may be merely the subjective expression of a vasomotor cramp, or spasm. Such a spasm of the coronary arteries in the present case may have led to disturbances of nutrition in the heart muscle affected and thus to acute necrosis of the muscle. They ask whether the vascular spasm may have been the original cause of the fits which developed during the last weeks of the patient's life. F. M. R. W.

## PATHOLOGY AND BACTERIOLOGY

**MacCallum, W. G. The pathology of the pneumonia in the United States Army Camps during the winter of 1917–18.** *N.Y.* 1919, *Rockefeller Inst. Med. Research*, 147 pp., 4°.

In this monograph W. G. MacCallum records the results of an extensive investigation into the morbid anatomy and infective aetiology of the great epidemic of pneumonia which swept through the United States Army Camps in America during the winter 1917–18.

It may be said at once—as was to be expected—that his exposition of pathological pictures is a model to be followed, for the experienced, highly trained morbid anatomist is revealed in every page. Frequent acquaintance with attempts on similar lines by unskilled amateurs—perhaps deservedly distinguished in other branches of medicine — enhances the pleasure of following this display of accurate observation and interpretation of tissue changes. It is moreover a relief to meet with an account of a histological research which is not based solely on the employment of a haematoxylin and eosin stain.

A short historical survey is given of great pneumonia epidemics of the past, measles being frequently mentioned as a concomitant, especially in the American Civil War.

With Bartels (1861) there began the accurate anatomical study of the form of broncho-pneumonia which follows measles, whooping cough, and diphtheria, his work being continued and enlarged by Delafield, Dürck, Orth, and especially Steinhaus and Hecht. As MacCallum points out, the conditions existing in the ancient epidemics were repeated on a greatly magnified scale in the course of the assembling of troops from all parts of the United States. It is pointed out that whereas many of the recruits were city born, had passed through all the ordinary diseases of childhood and had acquired immunity, others, and especially those from the South, had lived in remote rural districts under entirely different conditions, coming but little in contact with the outside world. They came to the camps unprotected from any disease except small-pox and enteric fever.

To the remaining exanthemata and to respiratory infections in particular these men were highly susceptible. In the inception of the epidemic measles must be given a prominent place. It prevailed to an extraordinary degree in many of the camps in the South, and there too arose the greatest outbursts of broncho-pneumonia.

Professor MacCallum believes that the great epidemic was one of broncho-pneumonia with measles as the most important predisposing background; but the broncho-pneumonia, itself a secondary infection, later arose independently of measles in individual cases and in other camps when the agents which caused the secondary infection became virulent enough to give rise to the infection independently. The present monograph analyses particularly the character of the respiratory diseases observed at Fort Sam Houston, Texas, during February and March, and at Camp Dodge, Iowa, during May, from the aetiological and anatomical standpoint.

Out of 38 broncho-pneumonic cases here dealt with, 20 had recently had measles or on admission still showed the rash. Two had rubella, 1 had scarlet fever, and 1 had diphtheria.

Pneumococcal lobar pneumonia showed no relation to measles, was uniformly distributed over all camps, and was not in excess of its usual incidence for the time of the year.

Altogether, Professor MacCallum chooses 49 fatal cases in which his records of bacteriological investigation both during life and after death are complete, and his monograph consists chiefly in a detailed consideration of the morbid anatomy and tissue bacteriology of these cases. A short clinical history with clinical bacteriological findings is given in each case. Except where conspicuous complications occurred the changes in organs other than the lungs are dealt with only briefly.

The 49 pneumonic cases are divided into five groups according to the pulmonary picture.

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|---|---|
| Interstitial broncho-pneumonia | 16 |
| Interstitial broncho-pneumonia combined with lobular pneumonia | 9 |
| Lobular pneumonia | 7 |
| Lobar pneumonia | 11 |
| Interstitial broncho-pneumonia and lobar pneumonia | 6 |

The combination of lobular with lobar pneumonia was not seen.

In every case of broncho-pneumonia (including 'lobular') a *Streptococcus haemolyticus* was found at some period of the course, and in the vast majority it was found throughout the course. In 30 out of the 38 cases it was found in sections of the lungs.

The influenza bacillus is not considered to have been a predominant agent in the epidemic. It was found in the sputum of 10 out of the 38 broncho-pneumonic cases and in 3 out of the 11 pneumococcal lobar pneumonias. In an addendum since his paper was sent to the press Professor MacCallum notes the subsequent great epidemic of pneumonia attributed to influenza. Using a new stain for Gram-negative organisms in tissues, the invention of Dr. Goodpasture, combined with Weigert's Gram stain, he has gone over his histological material again and has found morphologically-diagnosed influenza bacilli in the lungs in 16 of 48 acute cases, 5 of which were lobar pneumonia. He considers that, though it is difficult to assign to either the pneumococcus, the streptococcus or the influenza bacillus its exact part in the processes, this was essentially an epidemic of streptococcal pneumonia in which the influence of the epidemic of measles is obvious.

The above division of the streptococcal pneumonias is for the purpose of emphasizing the predominance of the various types of lesion, these types occurring together in the same lung, as is usual.

The general findings in the lung in the first group are:—Purulent bronchiolitis (bronchioles full of acute inflammatory exudate), peribronchiolitis (infiltration of wall of bronchiole and of peribronchiolar connective tissue), peribronchial pneumonia (exudation into alveoli of red blood corpuscles, fibrin and round cells, and proliferation and desquamation of alveolar epithelial cells) and peripneumonic collapse—a combination giving a very familiar picture. The nodular naked eye picture was often given a semblance of confluence by the intervening alveoli being filled with viscid, sometimes bloody, fluid—an appearance of 'gelatinous oedema' which was one of the most striking features of the lungs of subjects of the recent epidemic of influenza seen in London. But, over-riding this, in the opinion of the author, there was a most extensive acute, and later, organizing, infiltration of all the connective tissue of the lung:—peribronchial, perivascular, alveolar walls, interlobular septa, and pleura. This interstitial pneumonia is a frequent lesion in any pneumonia, but in this epidemic it was apparently most unusually pronounced; the thickened interlobular septa were often conspicuous to the unaided eye as broad white beaded cords. The lymphatics in these septa were thrombosed, full of blood, mononuclear wandering cells, fibrin and streptococci. This blockage favoured the retrograde (in the opposite direction to the normal lymph stream) extension, by continuous growth, of organisms to the pleura, thus accounting for the extraordinary frequency of empyema.

Streptococci were found, in sections, in the lumen of bronchioles and lymphatics and on the surface of pleural exudate but not in the connective tissues or alveoli, indicating the power of destruction exerted on them by the living cells in these cases. In this group of cases early organization of the inflammatory exudate was often seen: capillaries and fibroblasts were found budding into the fibrinous bronchiolar and alveolar content in cases where autopsy dated three weeks from onset of symptoms.

The foregoing all combine to emphasize the conflict against the infecting agent, so that streptococci were found in the peripheral blood only in the last hours of life or only at autopsy.

However important for the purposes of this monograph, the use of the term 'interstitial' broncho-pneumonia as a name for a pulmonary condition of which the interstitial infiltration is only one of many features, though a conspicuous one, is perhaps unjustifiable as well as dangerous; it is the kind of thing that inevitably creeps, through the agency of undiscriminating, inexperienced medical writers, into the text-books, to add to the confusion of the student.

The majority of the cases in this group therefore, in addition to interstitial pneumonia showed lobular pneumonia, a term which is used in this monograph as a 'convenient name for a patchy consolidation in which the alveoli contain leucocytes and fibrin'.

The second group of nine cases is separated to show the combination of lobular and interstitial pneumonia in an advanced degree. A possible explanation of this association is that the resistance of the tissues, as indicated by the interstitial infiltration, breaks down, enabling the peribronchial alveoli to become infected. Against this is the fact that the lesions occur together in the lungs of short-lived cases. Or, the development of severe alveolar infiltration may be due to hypersensitization of bronchi. Large numbers of streptococci now appear in the alveoli as well as in bronchi and lymphatics.

In Group 3, designated as 'lobular pneumonia', a patchy, often focally confluent, filling of alveoli with leucocytes, fibrin, and streptococci, is seen. Even this simplest form of reaction often failed, and over large areas the pneumonia was haemorrhagic, the alveoli only containing blood; the tissue becomes partly or totally necrosed. All stages towards abscess formation were occasionally seen. The lymphatics of the lung contained pus.

The streptococcal pneumonias were accompanied by a well-marked inflammatory swelling of the bronchial lymphatic glands. Microscopically, the sinuses of the glands were packed with mononuclear wandering cells rather than proliferated endothelium. The histological descriptions throughout the monograph are remarkable for the absence of information as to the particular types of round cells found; almost the only terms used in this connexion are 'leucocytes' and 'mononuclear wandering cells'.

Trachea and large bronchi were reddened and covered with the usual purulent exudate with occasionally a 'pseudomembrane' in the bronchi.

Aphonia was most often met with in measles cases; here there was reddening and oedema of the larynx and, in five cases, quite deep ulcers of the vocal cords with streptococcal strewn bases. The tonsillar crypts sometimes contained streptococci, without accompanying tissue reaction. The nose and its accessory sinuses could not be examined.

Acute pericarditis was found in three of the streptococcal pneumonias and in three of the lobar pneumonias; there was one empyema of the pericardium, in a case of streptococcal pneumonia. Acute endocarditis was present in two cases—in one of lobar (pneumococci in vegetations) and one of broncho-pneumonia.

In general, the spleen was only slightly enlarged and softened. In only one case, with pulmonary abscess and empyema, was there a really 'septic' spleen. Only slight or moderate cloudy swelling was noted in liver and kidneys. Acute nephritis was found in two streptococcal cases and two cases of lobar pneumonia. Acute peritonitis was not infrequent;

in one case it was possible to trace the infection through the lymphatics of the diaphragm.

Cessation of spermatogenesis was very commonly met with in the streptococcal forms and occasionally in the pneumococcal. Spermatozoa and frequently spermatids and spermatocytes were absent. Streptococci and pneumococci were infrequent in the organ.

Nothing remarkable was seen in the bone marrow. Occasionally an extensive hyaline degeneration of the muscle fibres of the rectus abdominis was noted, but only with the microscope. In two cases this was associated with rupture of the muscle and haematoma.

As regards bacteriaemia, 100 blood cultures from the arm were done but were negative except just before death, and even then positive results were few. When the pneumococcus and streptococcus were found associated in the tissues, the pneumococcus was isolated from the blood but not the streptococcus.

The fourth group of 11 cases of lobar pneumonia, is set forth for the purpose of contrasting the lesions. In some cases in which pneumococci were grown from sputum, &c., during life, these organisms were not obtained at autopsy, although *Streptococcus haemolyticus* grew. Case 45 is curious, showing mainly infiltration of alveolar walls, pneumococcal aortic endocarditis and pneumococcal abscesses in rectus abdominis muscle, with streptococci and influenza bacilli in sections of lung; it is difficult to see why it is not included in Group 1.

In Group 5, consisting six cases of interstitial broncho-pneumonia and lobar pneumonia, the pneumococcus was cultivated from the pulmonary areas affected by lobar pneumonia, and the streptococcus from the areas of broncho-pneumonia. The broncho-pneumonia is regarded as a superimposition on the pneumococcal lesion.

Appended as a group 6 are five cases of old persistent empyema, in which the intrapulmonary changes present at autopsy were slight.

Taking all inflammatory effusions as empyemata, these were extraordinarily common in the epidemic. In 21 cases (seven in Group 1, eight in Group 2, three in Group 3, and three in Group 4) there were sero-purulent and, less commonly, purulent pleural effusions of from one to three pints or more, being found at autopsy; these and other cases had ribs resected in life. Many other cases had smaller effusions; there were six interlobar effusions. Organization of the fibrinous pleural covering was a common and early event in the streptococcal pneumonias; inconspicuous in the pneumococcal form.

Accompanying this exhaustive memoir, which runs to 147 pages, there are 53 beautifully reproduced photographs and drawings of the lesions described. W. W. W.

**Mills, R. G. The pathological changes in the testes in epidemic pneumonia.** *J. Exper. M.*, 1919, **30**, 505.

In his monograph on the pathology of pneumonia in the United States Army Camps (see above), W. G. MacCallum drew attention to the fact that in cases of lobular pneumonia the testes showed extraordinary changes. These occurred most frequently in the streptococcic infections, but were also met with in cases dying from pneumococci. Material from 60 of MacCallum's cases was studied by R. G. Mills, and constitutes the subject of this communication, which was carried out in the department of pathology of the Johns Hopkins University. Mills gives a very careful account of the testicular changes which he considers were non-specific, focal in character, varying in severity directly with the total duration of the illness, and independent of the infecting organisms or the antecedent disease. In the absence of definite evidence to the contrary, the cause of the pathological lesions is assumed to be circulating toxins. The haemolytic streptococcus produced more extensive changes in primary pneumonia occurring during the measles epidemic than when pneumonia supervened as a secondary infection. Measles and epidemic influenza had little apparent effect on the testes, except that the former inhibited to a mild degree the process of spermatogenesis. The pneumococcus alone produced a uniformly slight degree of testicular change which was not intensified by an association with *B. influenzae.*

The testicular lesions consisted of cessation of spermatogenesis, degeneration of preformed spermatocytes, spermatids and spermatozoa, desquamation of altered cells, and fragments of the same. Giant cells were formed in the tubule walls and were subsequently set free in the lumen. In some cases there was thickening of the hyaline layer of the basement membrane. In general the Sertoli cells showed no evidence of marked alteration. W. B.

**Duval, C. W. and Harris, W. H. The rôle of the Pfeiffer bacillus in the recent epidemic of influenza.** *J. Infect. Dis.*, 1919, **25**, 384.

This study is based on numerous cases of influenza, occurring in New Orleans, and in particular on 75 Porto Rican sailors, ill with the disease, who were selected because they offered unusual opportunities in that they were all from the same source, and clinically presented the same infection. While under observation 17 of these sailors died and necropsies were made. In each of the 75 Porto Ricans the sputum yielded a bacillus considered to be identical with *B. influenzae,* Pfeiffer; a similar organism was found in the lungs in 16 of the fatal cases. During life no influenza bacilli were found in the blood, but in three cases were recovered from the heart-blood after death. The bloods from about 200 influenza patients, representing all stages of the disease, were tested for agglutination, and with few exceptions this effect was noted, many reacting in a dilution of 1 : 80. This exhibition of antigenic effect led the authors to attempt the protection of human beings with freshly killed cultures. Approximately 5,000 persons were vaccinated, each receiving three separate subcutaneous injections of 1,000 million organisms at intervals of three days. Decided local and constitutional effects were seen in 90 per cent. of those inoculated, 30 per cent. showing symptoms strikingly similar to those noted in influenza. Specific agglutinins were developed in all cases in 36 hours. The fuller details of this mass experiment will be published later. The authors consider that there is no adequate proof that Pfeiffer's bacillus is a member of the normal upper respiratory flora, although it may be found there in epidemic periods, especially in persons who have recovered from the disease. Such persons, in the opinion of the authors, are interim carriers, and constitute an important means for the transmission of the disease. They consider that Pfeiffer's bacillus is the primary cause of epidemic influenza for the reason that sufficient postulates in the recognition of its aetiology can be fulfilled.

W. B.

**Huntoon, F. M.** and **Hannum, S. The rôle of Bacillus influenzae in clinical influenza.** *J. Immunol.*, 1919, **4**, 167.

Dessicated suspensions of *B. influenzae* were pulverized and extracted with salt solution. After centrifuging an opalescent sterile supernatant fluid was obtained. This endotoxin was fatal to mice, and this result was due to a specific endotoxin rather than protein, because a 30 minute incubation of the endotoxin with immune horse serum before infection, counteracted its toxicity. Normal horse serum had no such effect. All mice were injected intraperitoneally, but no local lesion was produced. All animals, however, had acutely congested lungs and haemorrhagic exudates into the pleural cavities. Death occurred in from 18 to 72 hours.

The effect of the symbiotic growth of other bacteria upon this toxin was then tested. A heavy suspension of *B. influenzae* was made in broth. Some of this was inoculated with streptococci and some with pneumococci. All suspensions were incubated for 48 hours and then filtered. The filtrate was inoculated into mice. The influenza-streptococcus filtrate only was toxic, considerably more toxic than a streptococcus filtrate alone. Further, the picture at the autopsy differed in the two cases, and the toxicity of the mixture was counteracted by the same immune serum as protected against the ‘ endotoxin ’.

A number of strains of *B. influenzae* from different sources and isolated at different times, even before the epidemic period, all showed close relationships upon agglutination, absorption, complement fixation, and protection tests.

Experimental animals inoculated with the various toxins or with living bacilli showed, if death occurred, haemorrhagic lesions of the lungs wherever the inoculum was introduced. Some of the animals died of a spontaneous streptococcal or pneumococcal infection of the lungs after injection of influenza toxin. Animals which had been prepared with influenza toxin succumbed to sub-lethal doses of streptococci or to inhaling streptococci; further, living influenza bacilli produced death under these conditions. The lesions at the autopsy were always concentrated on the lungs. P. F.

**Pritchett, Ida W.** and **Stillman, E. G. The occurrence of Bacillus influenzae in throats and saliva.** *J. Exper. M.*, 1919, **29**, 259.

**Winchell, Agnes I.** and **Stillman, E. G. The occurrence of Bacillus influenzae in the normal throat.** *J. Exper. M.*, 1919, **30**, 497.

The authors made a study of the value of Avery's oleate-haemoglobin-agar in the isolation of *B. influenzae*, and determined the incidence of the bacillus in uncomplicated and complicated cases of influenza, in convalescent cases, and in the mouths and secretions of the throats of normal people. From 49 cases of uncomplicated influenza Pfeiffer's bacillus was found 41 times (= 83 per cent.). From 43 cases complicated with broncho-pneumonia the bacillus was found 40 times (= 93 per cent.). Six cases of broncho-pneumonia, which were probably late cases of influenza, all showed Pfeiffer's bacillus. In 20 cases of lobar pneumonia influenza bacilli were found in 11 (= 55 per cent.), and they were found in 25 (= 46 per cent.) of 54 convalescents from influenza. Normal persons to the number of 177 were examined and influenza bacilli were proved in 74 (= 42 per cent.). Of the 177 individuals 46 had received some kind of influenza vaccine, and of these 35 per cent. were positive influenza carriers, as compared with an incidence of 44 per cent. among 131 non-vaccinated individuals. These observations were based on single cultures in each case.

The types of pneumococci found were of interest, for whereas, normally, 60 per cent. of cases of lobar pneumonia are associated with Types I and II pneumococci, these types were not often encountered in the pulmonary complications of influenza. On the contrary, the dominant types recovered from influenza broncho-pneumonia were Types III and IV, which are frequently met with in normal mouths.

Winchell and Stillman continue the work of Pritchett and Stillman on the occurrence of influenza bacilli in throats and saliva. It is stated that Pritchett and Stillman's group of individuals comprised for the most part the personnel of the Rockefeller Institute, and Winchell and Stillman were able to carry out prolonged subsequent examinations on 84 of the same cases. They found that the incidence of *B. influenzae* in normal throats was as great in the post-epidemic period as it was during the epidemic itself. During December 1918 to June 1919 the percentage of carriers in a group of 150 persons averaged 41 per cent. per month, a figure very close to that obtained during the epidemic by Pritchett and Stillman. In a boys' orphan asylum, in which no case of influenza had occurred, 39 per cent. of throat cultures from 190 boys showed *B. influenzae*, this percentage being the same as that found in the examination of 52 convalescents from influenza in an institution for girls in which half of the personnel had suffered from the disease. In healthy carriers influenza bacilli was found in 6 instances over a period of 5 months, and in 13 instances over 4 months.

The medium used in these investigations was Avery's oleate-haemoglobin-agar, 5 c.c. of a 2 per cent. solution of neutral sodium oleate being added to 95 c.c. of meat infusion agar. One c.c. of a suspension of rabbits' erythrocytes was then added while the agar was hot. The optimum hydrogen-ion concentration for the isolation of *B. influenzae* appeared to be between $P_H$ 7·2 and 7·5. The authors point out that negative results were so consistently obtained with a medium having a reaction above $P_H$ 7·5 that little value can be placed on negative results with a medium of unknown hydrogen-ion concentration. W. B.

**Carpano, M.** Sulla vitalitá del Bacterium influenzae in alcuni prodati patologici e nelle culture. [**On the vitality of B. influenzae in some pathological products and in cultures.**] *Ann. d'ig.*, 1919, **29**, 280.

In moist media influenza bacilli will survive three months, whereas in dry media it dies out in four days. The best medium is agar-serum with haemoglobin, the best serum being that of the horse. Mixed cultures with streptococcus live longer than pure cultures, the optimum temperature for growth being 32–38° C. In pathological products such as exudates and blood the organism dies within 20 days. A. D.

**Wahl, H. R., White, G. B., and Lyall, H. W. Some experiments on the transmission of influenza.** *J. Infect. Dis.*, 1919, **25**, 419.

The objects of this research were: first, to determine the infective nature of bacteria-free filtrates as reported by Nicolle and others: second, to test the pathogenic action of various typical strains of influenza bacilli on man and to ascertain if their application will result in the production of influenza. Six volunteers were selected for the test and were then isolated.

Two had not been inoculated with influenza vaccine although one had been with pneumococcus vaccine. The remaining four had received influenza vaccine 4–6 weeks previously. The flora of the nares and nasopharynx was studied in each case. Two filtrates were prepared, the one from the lung of a fatal case of influenzal pneumonia in which were found pneumococcus Type II, *B. mucosus*, *M. catarrhalis* but no *B. influenzae*. The second filtrate was prepared from a pneumonic lung which was proved to contain *B. influenzae* along with *Streptococcus viridans*, pneumococcus Type IV and *Staphylococcus albus*. Ten grammes of the respective lungs were finely chopped, ground up with salt solution and sterile sand in a mortar, centrifuged and the supernatant fluid passed through a Berkefeld bougie, the clear filtrate being collected aseptically. This filtrate, which proved to be sterile on the application of ordinary culture tests, was sprayed heavily into each nostril and the nasopharynx of the two volunteers not previously vaccinated with influenza. The result was entirely negative subjectively and objectively. The application to the mucous membrane of the nares and nasopharynx of five of the volunteers of freshly prepared suspensions of four different living cultures of *B. influenzae* even in massive doses produced no untoward effect. One of the cultures employed was the first subculture obtained from a strain isolated directly from a fatal case of influenza. It may be noted that of the five men inoculated four had received influenza vaccine 4–6 weeks previously. The examination of the bacteria in the nose and nasopharynx subsequent to the inoculation showed that in most cases the influenza bacilli disappeared from the nose in less than 72 hours, whereas they persisted in the throat for several weeks, fluctuating in numbers from time to time. The authors themselves point out that only one of the individuals tested had not received a prophylactic injection of influenza or pneumococcus, nevertheless he also escaped the disease from implantation of massive doses of pure cultures of *B. influenzae* in his nose and pharynx.

W. B.

**Gibson, H. G., Bowman, F. B., and Connor, J. I. The etiology of influenza: a filtrable virus as the cause.** *Med. Research Committee, Spec. Rep. Series*, No. 36, 1919, 19.

This paper is practically a reprint of that already noticed (vide this Journal, 1919, **1**, 229) unfortunately, owing to the reasons indicated in the former review, no further work has been carried out and thus no light is thrown upon matters which are obscure.

The description of the lesions produced in animals by inoculation with filtered 'virus' is described in greater detail, and these bear a remarkable resemblance to lesions which may be produced in animals with virus emanating from *B. influenzae* (vide Huntoon and Hannum, *supra*, p. 532).

P F.

**Gay, F. P. and Harris, D. H. Serum reactions in influenza.** *J. Infect. Dis.*, 1919, **25**, 414.

After commenting on the dearth of knowledge on the serology of influenza the authors describe the results of experiments made with the sera of rabbits inoculated intravenously or subcutaneously with a mixed vaccine comprised of equal parts of ten different strains of *B. influenzae*. Pfeiffer's phenomenon of bacteriolysis, precipitin reaction, and conglutination reactions (Bordet and Gay) were negative. At 37° C. agglutination results were also negative but were positive when the tubes were maintained at 55° C. for 3–6 hours. Fixation antibodies were found in high dilutions.

Sera from acute cases of influenza, from convalescent cases, from persons vaccinated with cultures of influenza bacilli and from normal people were also examined. The following reactions gave entirely negative results: (*a*) agglutinin reactions at 37° C.; (*b*) conglutinin reactions; (*c*) opsonic tests; (*d*) precipitin tests; (*e*) intradermal tests made by injection of alcohol-killed cultures of *B. influenzae*; (*f*) fixation tests, using sputum, urine, or bacilli respectively as the antigens.

Agglutination tests incubated at 55° C. gave positive results, in dilutions of 1 : 80 and above in 88 per cent. of the cases examined. This was however only with certain strains of bacilli not with others. The serum from individuals that had recovered from influenza gave positive agglutinating results (55° C.) in about two-thirds of the cases; the sera of vaccinated persons were also positive in 45 per cent. of the cases, whereas the sera of normal persons were uniformly negative. W. B.

**Ferry, N. S.** and **Houghton, E. M. Some suggestive experiments with B. influenzae; its toxin and antitoxin.** *J. Immunol.*, 1919, **4**, 233.

In these experiments the toxin was obtained by growing *B. influenzae* for 18 to 24 hours in a blood broth made by adding 10 per cent. of rabbit or horse blood to broth and heating to 75°. The culture was centrifuged and filtered through a candle. The antitoxin was produced in one horse by inoculation with the above toxin and also with the unfiltered culture containing bacteria. The toxin was fatal for rabbits in doses of 2 to 5 c.c. intravenously. The animals usually died in two hours. The antitoxin was able to protect rabbits when mixed with the toxin 30 minutes before injection. It did not protect when given after the toxin. Similarly the antitoxin protected guinea-pigs from infection with living cultures when given 24 hours before or simultaneously. P. F.

**Heist, G. D.** and **Solis-Cohen, S. The bactericidal action of the whole blood of rabbits following inoculations of pneumococcus bacterins.** *J. Immunol.*, 1919, **4**, 147.

Whole blood *in vitro* possesses bactericidal properties which defibrinated blood or serum do not possess. This function is measured by filling a capillary tube with a suspension of bacteria and then, after discharging the suspension, filling up with freshly-drawn blood. Upon incubation some bacteria are found to multiply while others do not. These latter may be shown to be dead. This bactericidal power may be increased by immunizing the animal which supplies the blood with the bacterium in question. The virulence of a bacterium to an animal is in direct proportion to its power of growth in the animal's blood *in vitro*. When the virulence is increased so does the power of growth increase. Thus the bactericidal power of a sample of whole blood is taken as an index of the immunity of the species from which the blood was drawn to the bacterium. This test is more sensitive than agglutination as a measure of an immune response. P. F.

**Weaver, G. H. Droplet infection and its prevention by the face mask.** *J. Infect. Dis.*, 1919, **24**, 218.

The transmission of microbes by droplets of sputum was first made known through the classical researches of Flügge over twenty years ago, and the subject has been extensively studied by many investigators since. The present author deals with certain aspects of the question, especially with reference to the prevention of infection by masks of gauze. By spraying solutions of carbol fuchsin against gauze he was able to determine how much of the dye passed through and how much was retained. Continuing his experiments with suspensions of cultures of *B. prodigiosum* he found that the efficiency of the gauze is in direct ratio to the fineness of the mesh and the number of layers used. Passing to experiments in man, he obtained a suitable person, an adult with chronic suppuration of the antrum and ethmoidal sinuses—in whose throat *Streptococcus viridans* was abundant. Observations were made on this individual, and the results showed that three or four layers of gauze, with a mesh 44 by 40 removed most of the bacterial spray thrown with an unusual force at a short distance. On the basis of these experiments a mask was devised which proved to be effective, and has been extensively used by nurses in a hospital for infective diseases in Chicago. The reviewer has often been struck with the very inefficient apologies for masks worn in this country, and subjoins in detail the recommendations of the author as follows:

1. Cut (44 by 40 mesh) gauze 8 inches wide and 23 inches long.
2. Turn down the sides and one end $\frac{1}{4}$ inch. Fold twice, unturned end first, making $7\frac{1}{2}$ inches square.
3. Cut off opposite diagonal corners 1 inch and turn in raw edge $\frac{1}{2}$ inch. Stitch firmly all round.
4. Take up a 1-inch dart $1\frac{1}{2}$ inches long at middle of each side of mask. Sew 14-inch tape on opposite uncut corners.

This mask covers the nose and mouth and makes the traction on the chin, and not on the nose and lips. W. B.

**Corper, H. J., Donald, W. G.,** and **Antz, H. W. The organisms of secondary infection, especially pneumococci and streptococci in pulmonary tuberculosis.** *J. Infect. Dis.*, 1919, **24**, 496.

The 'mixed' or 'secondary' infections of pulmonary consumption have been extensively studied almost from the time of the discovery of the tubercle bacillus in 1882. At present there may be said to be three views. First, there is that of the Koch school, which holds that the lesions and more severe symptoms of phthisis are always and only the result of mixed infection. The second view is that the lesions may be caused by the tubercle bacillus alone, but secondary organisms may contribute to the more severe symptoms, or may be largely responsible for the unfavourable course of the disease. A third view is that 'mixed infections' play no essential part in the evolution of the tuberculous process.

The present authors have attempted to simplify the question by the examination of blood cultures from 216 cases of phthisis (104 incipient, 76 moderately advanced, and 36 far advanced). Both liquid and solid media were used aerobically and anaerobically. Growth was obtained in broth cultures alone, and in only seven of the cases. Four of these showed staphylococcus—a possible skin contaminator, one gave *M. tetragenus*, and two far advanced cases gave one pneumococcus Type II, and one pneumococcus Type IV, and *Streptococcus saprophyticus.* Eight of the 216 cases examined died within a month of the taking of the blood culture, all revealing extensive ulcerative pulmonary tubercle. Only one of these, however, gave a positive blood culture after death (pneumococcus Type II, in lungs and blood), whereas haemoculture one week before death was negative. Another case in which blood culture was positive three weeks before death yielded negative results after death.

Cultures from sputum, made at the same time as the blood cultures, revealed in the majority of cases pneumococci and streptococci, the most common pathogenic varieties being pneumococcus Types I and III, and *Streptococcus viridans.* A few pneumococci Type I, and haemolytic streptococci were found. Approximately 30 per cent. of the sputa revealed pathogenic pneumococci and streptococci.

No practical differences were noted in the percentage of pathogenic pneumococci and streptococci found when the cases were classed either as open or closed tuberculosis, with or without fever, and with or without râles. The work was carried out in the Laboratory of the U.S. Army General Hospital, No. 16. W. B.

**Morris, G. B., Porter, R. L.,** and **Meyer, K. F. The bacteriologic analysis of the fecal flora of children, with notes on the changes produced by a carbohydrate diet.** *J. Infect. Dis.*, 1919, **25**, 349.

The object of this careful and elaborate research was (1) to verify and support the contention of the clinician that a putrefactive intestinal flora in young children is associated with a definite syndrome in which bacteriological data may be of diagnostic value, and (2) to establish by means of a standard technique certain criteria by which the various types of faecal floras could be readily recognized whereby the transforming influence of certain foodstuffs could be controlled. Samples of faeces from 250 diseased and from 12 perfectly normal children were investigated, the methods of Torrey being employed as a basis. In a special series of cases repeated examinations were made to study the influence of diet on the course of 'intestinal intoxication'. The controls of this series were children suffering from surgical diseases and receiving a generous mixed diet, the composition of which is given.

The elaborate examination of each sample comprised:

1. Preparation of stock dilutions.
2. Microscopic examination and differential count of bacteria.
3. Plating procedures.
4. Inoculation of fermentation tubes.
5. Inoculation with undiluted stool.
6. Acetic acid glucose broth tubes,

Ad 1. The stool was collected on sterile gauze and examined within 2–3 hours, a sample of 500 mgrm. being weighed, emulsionized and diluted so that 1 c.c. of the dilution represented an equivalent of 10 mgrm. of faecal matter.

Ad 2. Smears from the stock dilution were stained by Gram's method, the films being examined with a square field ocular which enabled the ready determination of the percentages of Gram − organisms, Gram + organisms, Gram + rods, and Gram + cocci to be made. The authors found, however, that the differential count may be very misleading and 'we hope' they say 'that this abbreviated, antiquated form of stool analysis will ultimately be discarded as one of the routine procedures in the physician's office'.

Ad 3. Plates were made (1) by 'dallying' (*sic*) one loopful of stock dilution on two Endo plates; (2) dilutions of 1 : 10,000 and 1 : 100,000 were implanted into melted sugar-free veal or beef-infusion—Difco- peptone[1]-agar with PH 7·0–7·2 and plated; (3) Similar dilutions were plated in 1 per cent. lactose-agar; (4) a 'spore-plate' was made by inoculation from a portion of stock dilution which had been heated to 80° C. for 10 min. the subsequent incubation being anaerobic.

Ad 4. Fermentation tests were made in sugar-free veal peptone to which was added 1 per cent. glucose, lactose, or saccharose. Other tests were made in bromcresol-purple milk and in ordinary milk incubated anaerobically, the inoculum in the latter case having been heated.

Ad 5. One loopful of undiluted faeces was implanted into gelatine, Loeffler's blood serum and into lactose-peptone-ox-bile. Blood serum was found to be extremely useful, liquefaction and discoloration being always associated with a putrefactive stool.

Ad 6. Quantities of 0·5 c.c. were inoculated into N/5, N/10, and N/20 acetic acid veal infusion containing 1 per cent. glucose and peptone. In strongly putrefactive stools the absence of aciduric bacilli is regularly shown by sterile acetic acid tubes. Marked growth in N/5 and N/10 acetic acid broth is significant of a fermentative faecal flora.

The authors distinguish three types of flora: (1) fermentative or saccharolytic, (2) facultative or normal, and (3) putrefactive or proteolytic, and discuss in detail, with elaborate tables, the main characteristics of the three types and bring evidence to show that a strongly putrefactive flora is associated with certain groups of intestinal disorders of infancy and that clinical improvement is practically always attained on a strict carbohydrate diet. W. B.

**BENGTSON, IDA A. The proteus group of organisms, with special reference to agglutination and fermentation reactions and to classification.** *J. Infect. Dis.*, 1919, **24**, 428.

On page 213 of this Journal will be found a short review on some recent work on the bacteriology of the 'Proteus' group of bacteria. Our knowledge of these interesting microbes is carried a considerable step forward by the present authoress. She has made an elaborate study of the literature of the subject, and has enriched it by her own exact studies, by the most modern methods, on over 50 strains partly obtained from laboratories or isolated from faeces, meat, water, autopsies. A certain number of 'proteus species', strains of *B. cloacae*, *B. zopfii*, and *Pseudomonas protea*, Frost, are added for comparison. Besides her account of the methods of isolation, she considers in detail the morphology, motility, the growth on gelatin, milk, and a long list of fermentable substances, the production of brown pigment, indol, the Voges-Proskauer reaction, and the agglutinating reactions. With regard to milk, the divergence of results among different workers is partly due to the fact that proteus actively reduces litmus and masks the reaction. By using bromo-cresol-purple instead of litmus it was possible to distinguish the changes in reaction very readily. In 24 hours all the proteus cultures except one were slightly acid in bromo-cresol-purple milk, but showed no curdling. In three days, however, curdling occurred with peptonization, and in 14 days all showed a purple colour (alkaline reaction), while the remaining cultures were a decided yellow. With regard to fermentation reactions, she found that the kind of medium, the age of the cultures, and the length of incubation were not matters of indifference. Thus the presence or absence of meat extract in the carbohydrate medium influences to a great extent carbohydrate metabolism, especially in the case of saccharose. In peptone water all strains of proteus fermented glucose, none fermented lactose, raffinose, or mannitol, while saccharose and maltose gave variable results, in that all the strains from faeces failed to ferment these sugars, while strains from meat were able to do so. None of the true proteus strains gave a positive Voges-Proskauer reaction. Among Proteus vulgaris strains four isolated from meat, one from water, two from autopsies, and three laboratory stock strains gave a positive indol test, the remaining cultures all being negative. This correlated almost perfectly with the fermentation reactions in saccharose and maltose, the cultures recorded as producing a positive indol reaction consistently fermenting these carbohydrates.

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[1] Peptone made by Digestive Ferments Company Detroit, Mich. U.S.A.

The results obtained in agglutination tests point to the existence of a number of types. All the faecal strains were agglutinated to high titre by a serum derived from a faecal strain. This serum also agglutinated in high dilutions three strains from water, one from meat, and several laboratory cultures of unknown history. An immune serum derived from a culture isolated from a wound bandage agglutinated cultures of faecal origin, but usually in lower dilutions than was the case with the preceding serum, and also agglutinated several cultures not agglutinated by the serum derived from the faecal culture. The results seemed to indicate a type which was characteristic for cultures from faecal sources, and another one perhaps from putrefactive sources outside the body, as well as other types. Fermentation reactions were not found to be necessarily correlated with agglutination reactions. The agglutination of proteus by normal serum, the immune serum of patients with proteus infections, the serum of patients suffering from typhoid or typhus fevers was also investigated, as well as the occurrence of the microbe in normal and pathological conditions, such as infantile diarrhoea and epidemics of food poisoning. From an accurate tabular analysis of the latter the authoress considers that the conclusions are not established on a very firm basis. A chapter, showing extensive knowledge of proteus-like bacteria imperfectly described in the bacteriological literature of the past, deals with the subject of classification. W. B.

**Schaeffer, H.** Untersuchungen über Proteusbazillen zugleich ein Beitrag zur Theorie der Weil-Felixschen Reaktion. [**Researches on proteus bacilli, and a contribution to the theory of the Weil-Felix reaction.**] *Centralbl. f. Bakteriol.* (&c.), 1919, Orig. **83**, 430.

This research, carried out under the direction of Max Neisser, consists of studies on the biology of a series of proteus strains isolated partly from cases of typhus fever, partly from non-typhus cases (in Galicia), and partly from faeces, urine, and pus. In the general characterization of 'proteus' the author agrees with others. Mannitol and lactose were not fermented. He noted differences when cultures were grown on gelatine and on Loeffler's blood serum. Some liquefied both media, others liquefied blood serum, but not gelatine, while others liquefied neither medium. The fourth possibility of gelatine liquefaction, without serum liquefaction, was not observed. The author never saw a firm clot in milk inoculated with proteus, and noted several strains which had no effect on milk for seven days, although in general peptonization occurred.

With regard to indol formation, there are important differences in proteus strains. The majority in the series examined did not produce indol, whereas all the proteus X strains isolated from typhus and one faecal strain did. All indologenous strains fermented saccharose and maltose, these tests forming a means of subdividing the material examined into two main groups. Speaking of the agglutinating reactions with proteus serum, the author refers to certain peculiar results which have been demonstrated by Weil and Felix, Braun and Salomon, and by Sachs and Schlossberger.

If a typhus-proteus X 19 serum is tested with various typhus-proteus and non-typhus proteus strains, the result is that the typhus-proteus and some of those not emanating from typhus fever are agglutinated to titre. From this it might be inferred that proteus strains from typhus are identical, but that this is not so is shown when proteus strains are grown in a medium containing carbolic acid. When emulsions in such carbolic media are tested with the above-mentioned typhus-proteus X 19 serum it is found that non-typhus strains and many typhus strains are not agglutinated at all, or but slightly, while other typhus strains are still agglutinated to titre. If now typhus-proteus strains are tested with a serum obtained by inoculating a non-typhus strain which has agglutinogenic relations with typhus strains, one finds that the typhus strains are agglutinated in varying degree, from which it is assumed that the agglutinogenic components of typhus-proteus strains are not identical.

Working along similar lines with a large number of strains of diverse origin, Schaeffer found that there is a great multiplicity in the quantity and quality of the agglutinogenic components. Some of these components disappear in carbolized media, others persist, and he concludes that a satisfactory differentiation of proteus strains by agglutination tests is not feasible.

He also devotes a section to the complicated and unsolved problem of the mechanism of the Weil-Felix reaction. These authors have shown that about 10 per cent. of normal human sera will agglutinate proteus X 19 even up to dilutions of 1 : 50, and this in the main is confirmed in the work under discussion. By agglutination and absorption tests he shows that there is no fundamental difference between normal and typhus-proteus agglutinins, and that typhus sera may agglutinate other bacteria (certain strains of *B. coli* and colitis bacteria) in higher dilutions than normal sera. To explain these facts and the Weil-Felix reaction, he thinks that certain organs and tissues are affected in typhus fever, and that as a result certain substances are secreted by such tissues into the blood. If, perchance, these tissues normally produce agglutinins for certain bacteria, these same agglutinins would be increased in typhus fever and the titre of the serum would be raised above that which it normally possesses. He imagines that the increase in leucocytes might be responsible for these facts and would explain the specific typhus agglutination for proteus X 19. W. B.

**Eisenberg, Ph.** (1). Ueber Säureagglutination von Bakterien und über chemische Agglutination im allgemeinen. II. Mitteilung. Ueber den Mechanismus der Säureagglutination. [**On acid agglutination of bacteria and on chemical agglutination in general. Second Communication. On the mechanism of acid agglutination.**] *Centralbl. f. Bakteriol.* (&c.), 1919, Orig. **83**, 472.

**Eisenberg, Ph.** (2). III. Mitteilung. Ueber die sogenannte chemische Agglutination. [**Third Communication. On so-called chemical agglutination.**] *Centralbl. f. Bakteriol.* (&c.), 1919, Orig. **83**, 561.

Continuing his researches on acid agglutination Eisenberg, whose first paper was reviewed on p. 113 of this Journal, has studied especially the mechanism of the reaction, and in a long paper with complicated tables he sums up his results as follows.

Apart from the question of biological influence, acid agglutination of bacteria undergoes changes varying with physical, chemical, and colloidal factors. Heat causes the agglutination of typhoid bacilli to be lowered although increase of heat may cause its partial restoration. The slight acid agglutination of paratyphoid is usually destroyed by heating the culture. Acid-agglutinable coli and para-coli microbes behave like typhoid bacilli in that heat lessens the acid agglutination. Acid-inagglutinable coli and para-coli cultures are frequently made acid-agglutinable by heat. Formalin in general acts in a manner contrary to that of heat. The addition of acid usually weakens the acid agglutination, while alkali addition increases it up to the point of spontaneous agglutination. In the same manner act oxidizing agents in so far as they do not dissolve the bacteria.

The combined action of acids and heat act on all bacteria alike in the sense that they cause an increase in the acid agglutination up to the point of spontaneous agglutination and finally lysis. The salts of the alkalies and alkaline earth inhibit acid agglutination of typhoid and paratyphoid bacilli. Weak concentrations of such salts increase the acid agglutination of colon and paracolon organisms although a point comes when the acid agglutination is inhibited. It was noted that the acid agglutination of staphylococcus was greatly favoured by salts. Other bacteria tested conformed to one or other of these three types of effect indicating that the mechanism of acid agglutination cannot be the same in all cases.

In his third communication Eisenberg deals with the flocculation of bacteria by a great many chemical substances such as magnesium chloride, magnesium nitrate, calcium bromide, calcium nitrate, strontium chloride, and a variety of alums, especially ordinary alum and chrome alum. Various salts of copper, silver, gold, zinc, cadmium, mercury, cobalt, iron, thorium, cerium, are included as well as tartar emetic and uranyl acetate. The action of formaldehyde, ethyl alcohol, vesuvin, saffranin completes the list. Series of strains of typhoid, paracoli, and dysentery, cholera, and other bacteria were the principal test objects. W. B.

**Loewe, L., Hirshfeld, S.,** and **Strauss, I. Studies in epidemic encephalitis (encephalitis lethargica).** *J. Infect. Dis.*, 1919, **25**, 378.

This is a continuation of researches already abstracted on p. 90 of this Journal. In the present communication details are given of the successful transmission of the disease to rabbits by the intracranial injection of the filtrate of the nasopharyngeal mucous membrane from a fatal case of epidemic encephalitis. The animal died and showed punctate haemorrhages on the convexity of the brain with intense general congestion and meningitis with infiltration of mononuclear leucocytes. The meningeal vessels exhibited perivascular infiltration. The filtrates of brain emulsion from this case were injected into two other rabbits with positive results, while nasopharyngeal filtrates also set up the disease in rabbits. The virus was carried through four generations in rabbits, transmitted to a monkey in the fifth generation, and then brought back to rabbits in the sixth generation. It is stated that the virus can be recovered from the nasopharynx of animals injected intracranially. A natural immunity was found in approximately 50 per cent. of the rabbits employed. After passing successfully through a severe illness lasting ten days, a monkey was found to have acquired an immunity to a second dose, having manifested no symptoms, while another (control) monkey inoculated with the same nasopharyngeal filtrate showed typical lethargy, malaise, elevated temperature and left ptosis. At one time she was almost moribund but ultimately recovered. In a note at the end of the paper the authors state that cerebrospinal fluid from a fatal case of encephalitis caused the disease in rabbits, transfers from brain to brain being successful in this series through four generations. W. B.

**Mellon, R. R.** and **Anderson, L. M. Immunologic disparities of spore and vegetative stages of B. subtilis.** *J. Immunol.*, 1919, **4**, 203.

It was found that when a rabbit is immunized against the spore free vegetative forms of *B. subtilis* an agglutinating serum is obtained which affects the vegetative forms highly and spores partially. Similarly an antispore serum agglutinates both forms. But if the spores are freed from bacillary substance by extraction with 5 or 10 per cent. antiformin, then the antispore serum agglutinates spores only and the antibacillus serum does not agglutinate spores. Agglutinin absorption experiments showed that the apparent cross agglutination with impure spores was due to admixture with bacillary substance, and that there was a profound serological difference between the bacillary and pure spore antigens.

The authors issue a warning with regard to the preparation of anthrax serum with spores only. P. F.

**Schroeder, G.** Experimenteller Beitrag zur kenntnis des Friedmannschen Tuberkulosestammes. [**Experimental contribution to the knowledge of Friedmann's tuberculous strain.**] *Deutsche med. Wchnschr.*, 1919, **45**, 1124.

For the last two or three years the German medical press has been teeming with polemical articles on the value of Friedmann's tuberculosis cure which was generally believed to have been sufficiently discredited. With regard to the experimental side of the question it was held by some that Friedmann's culture—obtained from a tortoise—was innocuous, although Rabinowitz, Kaufmann, and others were not convinced on the point. Schroeder has repeated some of this work and has found that Friedmann's culture may be definitely pathogenic for the guinea-pig, and that its virulence is apparently exalted by passage. He also states that inoculation of rabbits with Friedmann's culture does not protect against a subsequent infection of a bovine tubercle infection. W. B.

**Celozzi, D.** Nuovo terreno di cultura d'uso generale in microparassitologia umana. [**A new culture medium of general utility in human microbiology.**] *Sperimentale. Arch. di biol.*, 1918, **72**, 291.

Human placentae, rapidly washed in water, pounded and weighed, are mixed with double the weight of Ringer-Locke solution and are then digested with 1 per cent. pancreatin in the presence of 0·5 per cent. chloroform. The digestion is stopped when the biuret reaction is greatly reduced and the tryptophane production is intense. Filter through muslin and then through paper. The reaction aimed at is that of the alkalinity of the blood. To the fluid thus obtained glucose (0·5 per cent.) and glycerine (2·0 per cent.) are added and the whole is sterilized discontinuously at 100° C. Besides the ordinary bacteria the author reports good results with his medium in the case of pneumococcus, meningococcus, gonococcus, diphtheria and tubercle bacilli. A. D.

**Kopaczevski, W.** et **Vahram, A.** La suppression du choc anaphylactique. [**The suppression of anaphylactic shock.**] *Compt. rend. Acad. d. sc.*, 1919, **169**, 250.

Sodium oleate injected into the jugular vein 10 minutes before the test dose of an anaphylactogen suppresses all severe symptoms of anaphylaxis. A 0·5 per cent. solution of saponin or 1 c.c. of a 1 per cent. solution of taurocholate and glycocholate of soda have the same suppressing effect. The authors consider that as these substances cause a lowering of blood-pressure this factor is of importance as well as the fact that they are colloids. A. D.

**Larson, W. P.** and **Bell, E. T.** **The perfusion experiment in the study of cellular anaphylaxis.** *J. Infect. Dis.*, 1919, **24**, 185.

In spite of the immense amount that has been written on the nature of anaphylaxis it cannot be said that its fundamental mechanism is completely understood. The school of Friedberger has maintained that the action is essentially a humoral one and that the antigen is broken up by the antibody with the production of a so-called anaphylatoxin. The study of 'passive anaphylaxis' (Otto) shows that after the injection of anaphylactic serum a certain incubation period must elapse before the manifestation of anaphylaxis consequent to the introduction of the antigen. It was the demonstration of this fact that led to the cellular theory associated chiefly with the work of Schultz, Dale, Weil and Coca. According to their view the site of the anaphylactic phenomena is within the cells and not in the tissue fluids.

Schultz and Dale washed the sensitized tissues free of blood by Locke's fluid and then exposed them to the stimulus of the spécific antigen, obtaining characteristic anaphylactic effects.

Larson and Bell offer a criticism on this mode of experimentation and allege that a certain amount of blood always remains in spite of an apparent complete and successful perfusion. Studying spontaneous phagocytosis, in the rabbit's liver, with Indian ink they found that the carbon particles were deposited only in restricted areas, although the organ had been traversed apparently completely by the perfusing fluid with the added ink. By means of a special technique (described in the original) they found that shortly after the perfusion was started, the fluid leaving the cannula in the vena cava was reddish but soon became clear. In about 15 min. there was no albumin reaction. Perfusion was stopped for 3 min. and then recommenced; the exit fluid contained red blood corpuscles and gave a protein reaction. Within 4 min. this had disappeared. The perfusion being again interrupted was restarted and was again followed by the reappearance of blood. This discontinuous application of perfusion was carried on for over an hour and although nearly two litres of Locke's fluid had traversed the liver, blood was still making its appearance in the exit tube. Perfusions of lungs and uterus are stated to have given approximately the same result. The explanation given by Larson and Bell is that the perfusing fluid traverses only certain parts of the liver and these soon become free of blood, but during the periods when the perfusion is discontinued blood from adjacent hepatic areas diffuses into the main path of the fluid and thus a renewal of the perfusion causes blood to reappear in the outflow cannula.

The authors argue that in anaphylactic experiments it is impossible to wash out all the antibodies and that the experiments of Dale, Weil and others cannot be regarded as proving the theory of cellular anaphylaxis.

W. B.

**Balard, P.** Sur un cas de survie d'uterus de femme parturiente. [**On a case of survival of the uterus in a pregnant woman.**] *Compt. rend. Soc. de biol.*, 1919, **82**, 1113.

An interesting case of a female, 6½ months pregnant, in which a large fibroma was attached to the uterus. As labour threatened, the womb with accompanying fibroma was removed, when it was found that although the os was softened it was of normal size. The os being enlarged with a scissors' cut the whole mass was laid on a plate at room temperature. Movements of the womb ensued and in 8 hours the head and arm of the contained foetus was expelled (photograph given). Whether this expulsion was due to neurogenic or myogenic influences could not be determined. W. B.

**Dienes, L.** Beobachtungen über das serologische Verhalten der giftarmen Dysenterie-stämme. [**Observations on the serological characters of hypotoxic dysentery strains.**] *Ztschr. f. Immunitätsforsch. u. exper. Therap.*, 1919, Orig. **28**, 456.

This work embraces the serological study of the Flexner and Y strains met with at a Mobile Laboratory at Lemberg. The cases came from various parts of Austria and Hungary during the campaigns of 1916 and 1917: some also were from Germans and Turks.

The author agrees with the view that no satisfactory classification can be based on sugar tests. The object of the study was to ascertain whether there exist definite serological races in this group of dysentery bacilli, or only irregular variations with intermediate types: whether again, the groups found coincided with those established by Kruse, and which sera were the best adapted for diagnostic purposes. He hoped to find answers to these questions by the careful study of a large series of unselected strains from a single epidemic. The number of strains examined was 88, exclusive of 22 which were at first suspected of being dysentery bacilli but could later be excluded.

The methods adopted were agglutination and absorption of agglutinins. For agglutination the macroscopic method was employed, readings being taken after 12 to 14 hours in the incubator followed by a few hours standing at room temperature. The absorption technique was a very thorough one: 6 c.c. of serum (diluted 250 or 500 times) were absorbed with several agar plates in succession till no more agglutination occurred, and then with one further plate. The writer disagrees with Wassermann that the absorption method is inapplicable to an investigation of this kind; he found its results consistent and parallel with other serological properties giving sharper grouping than mere agglutination.

The preliminary study of the strains was undertaken with three sera, with which he found it easy, as a rule, to distinguish between the dysentery bacilli of this group and other organisms. For the more complete study 13 sera were employed: with these the 88 strains were agglutinated on three occasions at intervals of nearly a year. Wide variations were sometimes noticed in the titre of a given serum for the same strain (e. g. from 1 in 2,000 to 1 in 16,000). Owing to agglutination amongst the various races, the author found it difficult to establish a satisfactory grouping on agglutination alone. The results of the absorption test, on the contrary, were sharp and decisive. Every strain about which there was the least doubt was submitted to this test.

Seven serological groups were established. Group I was the most numerous (41 strains): Groups II and III were represented by 9 and 7 strains respectively. Group IV was found 15 times. The remaining groups were less numerous (3 to 7 strains in each). Only two strains failed to fall into one or other of these 7 groups. Group I was identical with Kruse's Group A, Group II with Kruse's H, and Group IV with Kruse's D: the correlation with Kruse's other groups could not be established as Dienes had no examples of them. Kruse's Group E (fermenting lactose) was not, however, met with. Groups VI and VII were so distinct from the rest as to deserve rank as a primary race.

The author thus confirms Kruse's view that this group of bacilli, though probably a single species, falls into a limited number of well defined serological races, the members of each of which resemble one another closely. For the practical identification of these bacilli sera are required, not only representing Kruse's three main groups but also Dienes' VI and VII groups. One curious fact is noted: one of the earlier sera made (Group IV) was found to agglutinate *B. typhosus* and paratyphoid bacilli (including *B. Voldagsen*) to a high degree: a second serum prepared later from the same strain failed to exhibit this property. F. W. A.

**Pfeiler, W.** u. **Engelhardt, F.** Zeigt der Ferkeltyphus-bacillus (Bac. Voldagsen Dammann und Stedefeder) ein labiles biochemisches und agglutinatorisches Verhalten? [**Are the biochemical and agglutinative characters of sucking-pig typhoid (Bacillus Voldagsen of Dammann and Stedefeder) variable?**] *Ztschr. f. Immunitätsforsch. u. exper. Therap.*, 1919, Orig. **28**, 434.

This is a polemical paper designed to controvert a number of statements made by the Uhlenhuth School about the Voldagsen bacillus found in 'sucking-pig typhoid'. The earlier part of the paper is occupied by an indignant recital of the statements in question, which are to the following effect. The Voldagsen bacillus, which seems identical with *B. typhi suis* of

Glässer, was described in 1910 by Dammann and Stedefeder, who showed that besides ordinary swine fever due to a filter-passer, there was another disease attacking almost exclusively sucking-pigs and due to the Voldagsen bacillus. Händel and Gildemeister sought to prove that this bacillus was only a secondary invader, like *B. suipestifer* in the swine fever. Pfeiler and Kohlstock answered that Händel and Gildemeister had used in their experiments pigs more than three months old, a fact which vitiated their arguments. Further, it was alleged, that *B. Voldagsen* was labile in its characters, even on mere repeated subculture on agar, when it was apt to be transmuted into what was practically paratyphoid B. Bernhardt now interposed with a culture of *B. suipestifer*: Kunzendorf, which he alleged to be *B. Voldagsen*; he also cultivated from the organs of a fatal human case of food poisoning a bacillus which he thought was *B. Voldagsen*. These organisms after subculture on agar behaved like paratyphoid B, but would not agglutinate with a paratyphoid B serum, though they did with a Voldagsen and a Glässer serum. Pfeiler and Engelhardt deny that these strains of Bernhardt's were true *B. Voldagsen*: they regard *B. suipestifer*: Kunzendorf as a type biologically resembling paratyphoid B, but not agglutinated by paratyphoid B serum, though readily by Voldagsen sera. They have never met with 'Ferkel-typhus' bacilli in human infections, and they doubt Neukirch's observations on human Voldagsen infections. The explanation they offer of the confusion which has arisen is that true *B. suipestifer* from swine is agglutinated by Voldagsen sera, a fact which distinguishes them from *B. paratyphosus B* of human origin. They quote the observations of Teodorascu in support of this opinion.

Incensed by the allegations of lability brought against the 'Ferkel-typhus' bacillus the authors collected 30 strains from various sources, and submitted them to laborious subculture on agar for a year; at first they were subcultured daily, but later at somewhat longer intervals. At the end of a year they were again submitted to biological tests and to agglutination by a number of sera. Full tabular details are given of the tests before and after this prolonged subculture. The changes noted were of a trivial description; so far from mutation into paratyphoid B having occurred, the strains all lost what feeble power they had originally possessed of being agglutinated by a serum of this organism. A few strains which had originally failed to agglutinate to full titre with suipestifer and Voldagsen sera, were found to do so after subculture. They hence claim to have disproved the lability of the true 'Ferkel-typhus' bacillus, which in their opinion is an independent member of the 'coli-typhoid' group. It is distinguished from *B. paratyphosus B* and *B. suipestifer* by its more delicate growth on culture media, and by the fact that it produces a permanent red colour in litmus-whey, causes no change in Hetsch's mannite medium, and never reduces neutral red. Serologically, it is readily differentiated from paratyphoid B, but not from *B. suipestifer*: Kunzendorf. F. W. A.

## BIOCHEMISTRY

**Redonnet, T. A.** Beiträge zur Theorie der Narkose. [**The theory of narcosis.**] *Arch. f. exper. Path. u. Pharmakol*, 1919, **84**, 339.

The principal theory of narcosis at present being discussed is due to Overton, in which the fat soluble narcotics are supposed to combine with the lipoids of the nerve. Whether this combination results in a direct action on the lipoid cell content, or in rendering the membrane of the cell impermeable to oxygen, or in a secondary disturbance of the function of the cell, is still undecided. Redonnet has made experiments with neuronal, adalin, and bromural, and ascertained the quantities of these narcotics which are present in the brain and other organs at various stages of narcosis. He comes to the conclusion that the narcosis is not a quantitative function of the amount of narcotic fixed in the nerve lipoids. He believes that narcosis occurs because the brain lipoids are relatively more sensitive to these agents. C. G. L. W.

**Traube, I.** Die physikalische Theorie der Arzneimittel und Giftwirkung. [**The physical theory of therapeutic and toxic action.**] *Biochem. Ztschr.*, 1919, **98**, 177.

Two views are held with respect to the action of drugs and poisons. In the case of many narcotics, disinfectants, excitants, and alkaloids, it is thought that the physical properties of the substances are more closely connected with their action than is their chemical constitution. Some hold that the latter is the predominant characteristic. A review of the action of various drugs leads Traube to the conclusion that physical properties play a greater part in pharmacology than does chemical constitution. He believes that if the physical characteristics of substances assumed to be of pharmacological importance were determined, much time would be spared in the subsequent pharmacological examination. C. G. L. W.

**Lautenschlager, L.** Toxicologische Untersuchungen des M. Fickerschen Gasödemtoxins und seines specifischen Antitoxins. [**The toxicology of Ficker's gas gangrene toxin and its specific antitoxin.**] *Arch. f. exper. Path. u. Pharmakol.*, 1919, **85**, 1.

The bacterial source of the toxin is not given, but it would appear that L. was working with a toxin in which *vibrion septique*, and *B. oedematiens* were the principal agents concerned. The toxin is fairly stable in solution when small amounts are kept in evacuated containers at 5° C. It can be evaporated to dryness in a vacuum.

Rabbits are, weight for weight, a hundred times more susceptible to the poison than rats or mice. The toxin is a pure cardiac poison, very similar to digitalis. It acts on the 'all or none' principle. The minimum lethal dose acts as potently as larger doses. The rapidity of injection is a determining factor in toxicity. In this there is a certain similarity with the action of adrenalin, when the latter is constantly destroyed in the organism.

The antitoxin prepared by Wassermann and Ficker neutralizes the toxin. This mechanism can be shown with the frog's heart preparation. The titre of the serum can be thus determined.

The serum gives protection for 2–4 days after injection. The curative properties of the serum could not be established. C. G. L. W.

**Ellinger, A.** u. **Adler, L.** Die Wirkung von Ruhrgift auf den Kreislauf. [**The action of dysentery toxin on the circulation.**] *Arch. f. exper. Path. u. Pharmakol.*, 1919, **85**, 95.

Dysentery toxin acts on the central nervous system. The paralysis of the extremities is due to changes in certain ganglion cells of the spinal cord. The medulla is also attacked. The principal seat of action is on the heat-regulating and vasomotor centres. Animals become poikilothermous. If the body temperature falls very low the animals are unable to compensate in any way. With this fall in temperature the respiratory centre is injured and this leads to the death of the animal. C. G. L. W.

**Hahn, M.** u. **v. Skramlik, E.** Serologische Versuche mit Antigenen und Antikörpern und der überlebenden, künstlich durchströmten Leber. [**Serological experiments with antigens and antibodies in the perfused surviving liver.**] *Biochem. Ztschr.*, 1919, **98**, 120.

According to the authors, the rôle of the organs in the phenomena of haemagglutination and haemolysis cannot be investigated in a satisfactory way by experiments *in vitro* with tissue emulsion. In order to preserve the function of the organ it is better to work with the whole organ and allow the agglutinating agent to come in contact with it by perfusion.

Experiments were made with cobra toxin perfused through the liver, with amboceptor for sheep's blood, and with typhoid and *B. coli* agglutinins.

Substances are present in the liver which increase the action of cobra toxin on sheep's erythrocytes.

This substance passes into the perfusing fluid. The toxin so changes the character of the liver cells that the latter are capable of haemolyzing blood even after the toxin has been completely removed. The liver does not detoxicate cobra toxin when the latter is perfused through it.

Erythrocytes charged with amboceptor are retained in the capillary areas of the vena porta by agglutination, haemolysis subsequently takes place. Hence Bordet's view that agglutination is a first step in haemolysis is correct.

Agglutinins are held up by the liver and bacteria subsequently introduced on agglutination in that organ. The experiments show that the liver plays an active part in serological phenomena. C. G. L. W.

**Joachimoglu, G.** Zur Pharmakologie des Arsenwasserstoffs. [**Pharmacology of arsine.**] *Arch. f. exper. Path. u. Pharmakol.*, 1919, **85**, 32.

The results detailed in this paper are obviously those obtained in an investigation of the effects of arsine in chemical warfare.

Arsine in a concentration of 0·94–0·38 mgm. per litre induces a severe toxic condition in animals exposed to the atmosphere for an hour. This concentration kills when the animals are exposed to it for 12–40 hours. The formed elements of the blood absorb larger quantities of the poison than the lungs or the liver. Haemoglobinuria may occur. C. G. L. W.

**de Waard, D. J.** Mikrocalciumbestimmung direkt im Serum. [**Microestimation of calcium direct in serum.**] *Biochem. Ztschr.*, 1919, **97**, 186.

The calcium is precipitated directly in the serum without previous incineration. C. G. L. W.

**Zeller, H.** Diureseversuche mit Kochsalzlösung bei verschiedenartiger Zuführung. [**Diuresis induced by physiological sodium chloride solution.**] *Biochem. Ztschr.*, 1919, **97**, 189.

Experiments on the administration of physiological sodium chloride by various routes to healthy men. Subcutaneous administration produces a diuresis occurring at the end of 3–8 hours. It is not constant. Intravenous injection provokes a diuresis which may start an hour after administration. The elimination is usually greater than the amount administered.

When the solution is taken by mouth diuresis starts in 1–2 hours. It is quickly over. C. G. L. W.

**Lasch, W.** Zur Kenntnis der Oxydationsvorgänge im menschlichen Organismus. [**Oxidation processes in man.**] *Biochem. Ztschr.*, 1919, **97**, 1.

The author has attempted to measure the capacity of man for oxidizing sodium thiosulphate. Amounts up to 12 gms. per day were given, and the amount of alkaline and ethereal sulphates in the urine estimated. The oxidation of thiosulphate obeys the same rules as does the oxidation of phenol. The total quantity of sulphates increases in the urine but the relation of sulphates to total sulphur diminishes. Ethereal sulphates are increased. C. G. L. W.

**Asher, L. u. Messerli, F. M.** Beiträge zur Physiologie der Drüsen: 39. Das Verhalten der weissen Blutbilder beim normalen, schilddrüsenlosen und milzlosen Tier unter Einwirkung von Sauerstoffmangel. [**Differential blood count in normal, thyroidectomized and splenectomized animals under the influence of lack of oxygen.**] *Biochem. Ztschr.*, 1919, **97**, 40.

Investigation of the blood findings of splenectomized and thyroidectomized animals under the influence of oxygen want. The animals were placed in a chamber in which part of the oxygen was replaced by nitrogen. Under these conditions in normal animals a lymphocytosis occurs.

Thyroidectomized animals also show a lymphocytosis. With splenectomized animals leucocytosis is the first blood phenomenon which is replaced later by a lymphocytosis. Under the influence of lack of oxygen there is a continued leucocytosis, with increase in the myeloid elements of the blood. C. G. L. W.

**Cole, S. W.** **Practical physiological chemistry.** Fifth edition. *Heffer & Sons, Ltd., Cambridge.* 8vo., pp. 401, 1919.

The fifth edition of this book has been almost completely re-written and enlarged. It serves as the basis for a very complete course in physiological chemical technique. The experiments are given in detail, and with them sufficient theory of the processes involved to give the student a clear conception of the principles underlying them. The descriptions in the experimental part possess the great advantage that the author has personally gone through the operations many times, and has added many helpful details obtained by his own experience.

The selection of methods has been made with good judgement. The present edition ought to enlarge considerably its already wide distribution.
C. G. L. W.

**Lambling, E. Précis de biochimie.** Deuxième édition. *Collection de précis médicaux, Masson et $C^{ie}$, Paris.* 8vo., 708 pp., 1919, price frs. 15.

This book, which is divided into twenty-six chapters, gives a very excellent account of the present knowledge of biochemistry. Some of the chapters, which are new, or have been entirely re-written, are those on the chemical specificity of micro-organisms, vitamines, protein minimum, growth and repair.

As the author was prevented from leaving Lille at the outbreak of the war, he was able to study at close quarters the effects of under-nutrition in the inhabitants of that city. A very full author and subject index is given.
C. G. L. W.

**Host, H. F. Study of the physiology of endogenous uric acid.** *J. Biol. Chem.*, 1919, **38**, 17.

Estimations by the Folin and Folin and Denis methods have been made of the uric acid concentrations in the blood and the urine of normal and convalescent patients who have never had symptoms of gout. The conclusions are that the endogenous uric acid output is dependent upon several factors. A rise or fall in the caloric value of the food changed the output of uric acid in the same sense, whether the change was due to protein, fat or carbohydrate, being greater when varied by protein. The excretion of nitrogen and the hydrogen-ion concentration of the urine were without influence on the endogenous uric acid output. Increase of body temperature increased it. The endogenous uric acid output varied from 0·27–0·99 gms. in 24-hour periods. Contrasted with this irregularity the uric acid in the blood was very constant for the same individual, being most usually 0·01–0·02 gms. per 100 c.c. of blood. The endogenous uric acid in the urine is, therefore, a measure of the uric acid formation, which is, apparently, very irregular in some individuals.
R. A. P.

**Emmett, A. D.** and **Luros, G. O. Lactalbumin.** *J. Biol. Chem.*, 1919. **38**, 257.

Lactalbumin promotes the growth of rats after heating to a high temperature with and without butter fat. The basal diet used was protein-free milk 28 per cent., butter fat 5–28 per cent., lard 0–10 per cent., and starch to make up the balance. The difference between casein and lactalbumin is suggested to be due to a vitamine.
R. A. P.

**Hess, A. F.** and **Unger, L. J. Scurvy of guinea-pigs. III. The effect of age, heat, and reaction on anti-scorbutic foods.** *J. Biol. Chem.*, 1919, **38**, 293.

The protective action of carrots against guinea-pig scurvy depends upon the time elapsing between picking and treatment (whether cooking, dehydrating, or eating raw). Canned tomatoes are found to be a good anti-scorbutic. The results of Harden and Zilva that alkalis destroy the anti-scorbutic potency of orange juice are confirmed and found to hold also for canned tomatoes. R. A. P.

**McCollum, E. V., Simmonds, N.,** and **Parsons, H. F. Biological analysis of pellagra-producing diets. VI. Observations on the faults of certain diets comparable to those employed by man in pellagrous districts.** *J. Biol. Chem.*, 1919, **38**, 113.

This is the sixth of a series of papers dealing with this type of diet. Rats are used for the experiments (and the authors refer to the differences between rats and guinea-pigs in these dietary experiments). The authors distinguish between two classes of vegetable foods—leaves and storage tissues. Mixtures of seeds, or of seeds, tubers, and roots, require supplementing with the inorganic elements calcium, sodium, and chlorine, and with fat-soluble A, so steak which is poor in fat-soluble A and in inorganic salts cannot supplement this diet. The best supplements are milk, eggs, and leafy vegetables, called 'protective' foods by the authors. A poor state of nutrition, but no actual pellagrous condition was observed in the animals upon the pellagra-producing diets; the authors believe pellagra to be infection superimposed upon lowered vitality. They recommend the extensive use of milk, and to a lesser extent eggs and leafy vegetables as correctives to the diets in pellagrous districts. R. A. P.

**Hart, E. B., Steenbock, H.,** and **Smith, D. W. Studies of experimental scurvy. Effect of heat on the anti-scorbutic properties of some milk products.** *J. Biol. Chem.*, 1919, **38**, 305.

Using guinea-pigs, the authors have confirmed the results of Chick and her associates that on a diet of rolled oats and hay, the prevention of scurvy by raw milk depends upon the dose. By sterilizing at 120° for 10 minutes, both milk, commercial unsweetened condensed milk and commercial milk powder lost their anti-scorbutic power when given in doses equivalent to the dose of raw milk required. The authors also bring further evidence against the view of the intestinal origin of scurvy by showing that neither phenol phthalein, mineral oil. or lactose are preventives in themselves.

R. A. P.

# RADIOLOGY AND ELECTROLOGY

## *Radiotherapy*

**Haret, G.** Quelques cas de maladie de Paget traités par la radiothérapie. [**Paget's disease treated by radiotherapy.**] *J. de radiol. et d'électrol.*, 1919, **3**, 416.

In 1909, 1910, and 1913, the author treated three cases of Paget's disease of the nipple in women of 70, 42, and 40 years of age respectively. The symptoms of the first case were ulceration of the centre of the retracted nipple, sanguineous discharge, and pain in the mammary gland; the second appeared normal, but was slightly painful and there was a small discharge; the third showed an eczematous condition, with a growth in the gland, the nipple had disappeared, and in its place was a large ulceration which discharged, there was a growth the size of an almond, not adhering to the skin or to deeper parts, and several glands in the armpit. Each case was treated by irradiation of the whole gland with 3 H-units of No. 7 Benoist rays filtered through 1 mm. of aluminium. The séances were continued until all symptoms had disappeared. The third case also used a solution of chlorate of magnesia both internally and externally. After 10, 9, and 6 years respectively the patients declare themselves perfectly well. Two other cases are improving under treatment.

The author believes that although five cases are not sufficient from which to draw definite conclusions, Paget's disease, in spite of former opinion to the contrary, will prove amenable to radiotherapy.

S. U. L.-B.

**Wilms.** Heilung der Trigeminusneuralgie durch Röntgenbestrahlung. [**Treatment of trigeminal neuralgia.**] *München. med. Wchnschr.*, 1918, **65**, No. 1. (*Centralbl. f. Chir.*, 1918, **45**, 819.)

The author obtained generally good results with X-rays in 12 cases of neuralgia of the trigeminus, and in those which had followed on inflammation (parotitis, influenza, inflammation of antrum, &c.) benefit was obtained in a few hours up to two days owing, he believes, to destruction of the injurious substances (toxin, &c.) in the nerve or ganglion. In some cases of rheumatic origin the neuralgia reacts quickly after a single treatment; if the pain is much increased after the first radiation, it mostly disappears on the repetition of a strong dose over two to four areas. In other cases there is a slower improvement extending over 8–10 days. In three cases the result was poor, two of them improving for a few days after several radiations, and then recurring, one case scarcely improved and called for surgical treatment; amongst these three, two had been given injections for a long time.

W. maintains that this rheumatic neuralgia depends upon excretion of metabolic products. Alcohol injections are not an equivalent method of treatment and should not be resorted to until it is assured that the case is not suited for Röntgenotherapy. He considers that recurrence is possible in the latter cases and also expects failure in cases where the bony canals of the skull, &c., are particularly narrow. He gives deep therapy with 3 mm. aluminium filter and from 30–40 X over both temporal regions and the sides of the face. He had good results also in other forms of neuralgia.

W. S. L.-B.

## *Radiography*

**Akerland.** Entwicklungsreihen in Röntgenbildern von Hand, Fuss und Ellbogen im Mädchen- und Knabenalter. [**Development of ossification in hand, foot, and elbow in adolescence.**] *Archiv und Atlas der normalen und pathologischen Anatomie in typischen Röntgenbildern*, **33**. (*Centralbl. f. Chir.*, 1919, **46**, 143.)

The author presents excellent plates of the development of ossification in the hand, foot, and elbow of 28 boys and 28 girls, aged from 8–14 years, mostly from the Stockholm elementary schools. The sexes had to be considered separately, since the earlier occurrence of ossification in the female causes the two series of development to be on different planes. Only healthy children were chosen, who had neither rickets, syphilis, tubercle, nor derangement of the internal secretions. Nevertheless, the influence of these conditions cannot be ignored in the ossification process. The subjects were chosen of average size for age, for, as is already known, there is a parallelism between the degree of ossification and the length of the body. These observations afforded a further confirmation of this point. The degree of ossification was defined by a detailed study of the radiographs of the hand, foot, and elbow of each child. In individual curves of ossification the author shows clearly the influence of different factors (height, weight, constitution) on bone-development. It appears that to a still greater degree than the length of the body, the constitution is of importance in ossification. With a strong constitution is found, almost without exception, a more advanced ossification. The value of the atlas lies in the fact that this series of plates of the normal with its survey of the appearance of centres of ossification and synostosis, and of carpal and tarsal development, is immediately available for comparison with any particular pathological condition with which the surgeon may meet. S. U. L.-B.

**Hetz.** Die Heilung der kongenitalen Knochensyphilis im Röntgenbild unter dem Einfluss der spezifischen Therapie. [**Radiographic changes undergone by bone during the cure of congenital syphilis.**] *Cor.-Bl. f. Schweiz. Aerzte*, 1918, **20**. (*Centralbl. f. Chir.*, 1919, **46**, 28.)

Osteochondritis luetica is by far the most common pathological and anatomical symptom of congenital syphilis. The process of its healing by specific treatment is still relatively little known, and on that account the author describes a peculiarly interesting case. A child of about 3 months had, in addition to other indications of congenital syphilis, a swelling on the ulnar side of the right forearm, which on the X-ray plate was recognizable as a bulbous swelling of the proximal metaphysis. After 3 weeks' treatment (neosalvarsan intravenously, hydrarg. iod. flav. internally, and intermuscular injection of calomel) the ulna became smaller, the nebulous structure had solidified, the translucent parts were smaller; bone formation had begun. Ultimately the normal shape and density of the bone were restored, and there only remained small clear spaces in the periosteum. After about 10 weeks, cure was complete. The marked tendency towards healing of bone in the infant diminishes with increasing age. The Wassermann reaction may be positive in spite of complete anatomical cure, or negative though cure is incomplete. S. U. L.-B.

**Cerdéiras.** Die Bronchialdrüsen im Röntgenbilde. Vergleich zwischen Röntgenbefund und Sectionsergebnis. [**Bronchial glands. Comparison between results furnished by X-rays and by autopsy.**] *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1918, **25**, Heft 3. (*Centralbl. f. Chir.*, 1919, **46**, 56.)

A number of cases are presented with the corresponding radiographs. The author's most important conclusion is that in tuberculosis frequently neither caseation nor simple infiltration of the bronchial glands with tubercle is recognizable on the X-ray plate. Further, the sign which is sometimes stated to be characteristic, namely that, in tuberculosis, the normal clear space between the shadow of the root of the lung and the middle shadow tends to disappear, does not always hold good. The extension and intensity of the hilum shadow is influenced to a much greater degree by pulmonary congestion, by a high position of the diaphragm, and by pleuritic adhesions, than it is by the size of the glands. Indeed, very few cases of tuberculosis in which the disease is closely confined to the hilus are found *post mortem*. The author has only seen one such case. The clinical picture of this hilus tuberculosis does not, as a rule, correspond with what is usually interpreted as hilus shadow. This is a further reason against belief in the frequent occurrence of tuberculosis at the root of the lung. Once more it is seen that one is not necessarily justified, on the grounds of an X-ray plate, in overthrowing the teachings of morbid anatomy. S. U. L.-B,

**Maul, H. G. Bone and joint lesions of yaws with X-ray findings in twenty cases.** *Am. J. Roentgenol.*, 1919, **6**, 423.

One hundred cases of yaws were collected, the diagnosis having been carefully made and the *Treponema pertenue* demonstrated in those with open lesions. Twenty per cent. of this group suffered from bone or joint lesions. An X-ray examination of all the bones of the body was made in each case and subsequent plates taken to observe the progress.

It was found, in the majority of cases, that the lesions show as rarefied areas, irregularly oval or elliptical in shape, with the long axis parallel to that of the bone. The size varies from the smallest discernible area to one that is two or three cm. in length. The rarefaction presents moderately well-defined borders separating it from the unaffected bone; and varies in translucency from the slightest change to one simulating a perforation. Most of the lesions appear to start in the interior of the bone, while a number can be seen in small excavations on its outer surface. When the lesion is on the surface of the bone, the periosteum is usually destroyed, but occasionally the cortex shows thickening, and the periosteum separated from the bone.

In chronic lesions marked irregularity of the bony outline is evident, and the picture characteristic of the earlier lesions is more or less lost. The bone as a whole becomes deformed, and its growth is interfered with both in length and breadth.

Within the joints the distinction is most frequently seen on the parts of the articular surfaces most exposed to trauma as oval or irregularly shaped excavations, making the outline of the articular surface rough and uneven.

The radiographic picture of yaws is different from that of syphilis in that the periosteal proliferation is absent, as is also the thickening of the cortex. R. W. A. S.

## *Radiotechnique*

**Lilienfeld, J. E.** Neue Eigenschaften der Röntgenstrahlung. [**New properties of Röntgen rays.**] *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1919, **26**, 393.

The anticathode of a Röntgen tube emits, in addition to heat and Röntgen rays, a greyish-blue light. This has not been observed hitherto, as it is usually obscured by the fluorescence of the glass walls. Such is not the case with a Lilienfeld tube, and the author has examined the light spectrographically. It presents a continuous spectrum, which is very similar to that of a solid body at a very high temperature. It is suggested that this might afford a means of determining the temperature of the anticathode. The light is completely linearly polarized parallel to the plane of the anticathode, the plane of polarization being independent of the angle of incidence of the cathode rays.

There are indications that the Röntgen rays are similarly polarized, but this has only been proved for those which proceed from the outer edges of specially shaped anticathodes. These observations confirm a prediction of the author that the heat, light, and Röntgen rays have a common vibrational origin. J. R. C.

**Pfahler, G. E. The injection of air for the Röntgen diagnosis of tumours of the bladder.** *Am. J. Roentgenol.*, 1919, **6**, 371.

The technique is described, and it is stated by the author that he has never had any disadvantage or serious objection to the examination either by the patients or by any bad after-results.

By this method new growths as small as a thimble and in various parts of the bladder have been demonstrated. It is pointed out that one cannot decide positively whether the new growth is malignant or benign, but as all benign growths tend to become malignant later on, the treatment should be the same.

An enlarged prostate can also be shown by this method, which gives the further advantage of showing the condition of the upper and anterior surface. This helps to differentiate between simple enlargement and malignant infiltration. R. W. A. S.

**Regener.** Über die Perspektive der Röntgenbilder. [**The perspective of radiographs.**] *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1918, **25**, 215. (*Zentralbl. f. Chir.*, 1918, **45**, 947.)

The war has brought forward a large number of methods of locating foreign bodies—some of these being of considerable value. But there is a danger that old simple methods may be relegated to the background or false judgements be deduced from ignoring fundamental principles. In many cases certainly the method of negatives taken in two directions suffices, when one possesses a special knowledge of the perspective of X-ray negatives. It is important to view the plate at such a distance from and such a position with regard to the eye, as it was placed with regard to the bulb at the time of the exposure. Only under such conditions is the observer in a position to appreciate correctly and in one perspective the position in space of the shadow-throwing bodies from study of the shadow pictures on the negative and interpret the usual observation that portions nearest the eye are larger and those more distant are smaller.

When looked at from the other side the opposite obtains, so that the perspective is reversed as regards the depth of the direction, and the distant object becomes larger than the nearer one, and the correct space association of a single part of the picture is placed in question. More particularly foreign bodies appearing on the plate are in danger of being falsely indicated in space. The author describes the procedure fully, and explains it in photos that were taken under the same conditions with the X-ray tube and with the camera. The comparison works still better between X-ray negatives and photographic negatives in reference to perspective, when in place of an irregularly formed body a body of known mathematical proportion is employed for the experiment. In that case it is, as a matter of fact, difficult to distinguish the radiograph from the photograph. Every radiologist will find the work worth reading. W. S. L.-B.

## *Radio-biology*

**Lazarus-Barlow, W. S. An attempt at the experimental production of carcinoma by means of radium.** *Proc. Roy. Soc. Med.*, 1918, **11**, 1.

The experiments were conducted with a view to producing carcinoma in animals by means of the radiations from radium. Rats and rabbits were selected for the purpose, the methods adopted in the two cases were, however, different. In the case of rats, measured quantities of radium enclosed in small glass tubes were inserted beneath the skin in the axillary region; preliminary experiments were made with quantities of radium ranging from $10^{-8}$ to $10^{-3}$ mg. radium element. With a quantity of $6 \times 10^{-4}$ mg. remaining for 44 days in the animal, just recognizable effects upon the hair were obtained. Consequently larger quantities were used in later experiments, the original procedure being otherwise adhered to, the quantities of radium involved now varied from about one-thousandth to one-seventh of a milligram. Greater changes were now observed, consisting macroscopically in loss of hair and the formation of ulcers.

The general conclusions drawn from a series of 53 rats under varying conditions of quantity of radiation and time of exposure were: that under continued irradiation, down-growths of the epidermis occur, and that several of these down-growths show the presence of cell-nests; a result, be it noted, analagous to that of Thies in the case of the guinea-pig. In no case, with one possible exception, did the epithelial down-growth invade the subjacent muscular layer.

In the experiments on rabbits, six animals had gall-stones introduced into their gall-bladders, the stones having previously been drilled out to contain a small quantity of radium. Three control rabbits had normal gall-stones similarly introduced. The experimental animals died after periods ranging from 12 to 48 months after operation. In the case of the rabbits irregular proliferation of the columnar cells was the most striking feature observed in contrast to the findings in the control animals.

Particular interest centred round the finding beneath the capsule of the liver of one rabbit (12 months animal) of a single focus of tissue consisting of irregular tubules lined with columnar epithelium set in fairly dense fibrous tissue and in close relationship with the pancreas. As a result of microscopic examination, the author inclines to the view that the focus in question constitutes a metastasis; the gall-bladder of the animal in question showed the formation of irregular tubules invading the deeper-lying parts. The general conclusions of the author are that the microscopic appearances in the rat and rabbit indicate early conditions of squamous-cell carcinoma and columnar-cell carcinoma respectively.

In this connexion, namely, the attempted production of carcinoma, we may recall the experimental production of sarcoma in the rat by means of X-rays, the work of the late Jean Clunet. S. R.

## *Radium Therapy*

**Giffin, H. Z.** Splénectomie pour leucémie myélogène après traitement préalable par le radium. [**Radium treatment followed by splenectomy in myelogenous leuchaemia.**] *Med. Rec.*, 1918, **94**, 24. (*J. d. radiol. et d'électrol.*, 1919, **3**, 378.)

The author comments on the results of 20 splenectomies performed at the Mayo clinic for myelogenous leuchaemia, 18 of which had had preliminary treatment of the spleen by radium. Under the influence of the radium the spleen became smaller, a diminution of the leucocytosis, and an evident improvement in the general condition took place. There was only one death under operation, which gives an operation mortality of 5 per cent. which, the author states, is less than the average mortality in splenectomy. Moreover, the operation mortality in splenectomy for myelogenous leuchaemia, not previously treated with radium is, according to statistics, 86 per cent. Thus the operation results are excellent. More remote results noted by G. are as follows: improvement in the condition of the patient is certain and always appreciable, but the results of operation from the point of view of survival are nil; even if splenectomy does not shorten the average duration of myelogenous leuchaemia, which is generally from 2 to 3 years in acute cases, it does not seem to prolong it. If the patient is operated upon soon after the appearance of the disease, post-operative survival is longer; it is shorter if operation is late, the whole duration of the disease remaining the same. The author thinks that, in certain chronic types of myelogenous leuchaemia, of fibrous spleen, and of slightly increased leucocytosis, splenectomy after radium treatment might be considered legitimate, if only because of the improvement it effects in the condition of the patients.

S. U. L-B.

## *Electrotherapy*

**Langier, H.** Application des courants lentement croissants au traitement électrique des muscles dégénérés. [**Degenerated muscles treated by slowly increasing electric currents.**] *Presse méd.*, 1919, **27**, 385. (*Arch. d'électric. méd.*, 1919, **27**, 277.)

After discussing the action of the induced shock (faradic current) and the formation of the continuous current, or the association of the two (galvano-faradic) on muscles which, because of nervous lesions, no longer contract voluntarily, the author shows the difficulty there is in applying these currents in the treatment of certain highly inexcitable muscles. In these cases the intensity necessary to obtain a contraction of the injured muscles is enormous, and provokes violent and painful contractions in the neighbouring healthy muscles or in the antagonistic muscles, and the treatment, instead of being salutary, often causes permanent contractions. It is therefore necessary to abandon this method of treatment and to replace it by that of a continuous uninterrupted current, but this method also does not fulfil the required conditions. If, however, a slowly increasing current be used to contract electively the injured muscles, a very different result is obtained. Experience has shown that if progressive currents are less efficacious in leading to contraction than those which are sudden to begin with, sluggish tissues and muscles, and consequently degenerated muscles, are more easily excitable by them than healthy tissues and muscles. Realization of such a current is not at all difficult, and, following Lapique's method, it is obtained by placing in series in the circuit of the continuous current, on the exciting electrode, condensers the capacity of which can be varied at will. It is easily understood that the current cannot reach its maximum strength until it has charged the condensers. The same result can be obtained by placing different self-inductances in series with the same electrodes. In fact, by introducing greater and greater self-inductances, establishment of the current becomes slower and slower, and consequently its efficacy diminishes, and in the end, the degenerated muscles alone become excited. Such an apparatus can be handled by the usual assistants in electrotherapy, and for that reason the author suggests that it should be generally used in all cases where treatment is required for a mixture of degenerated and healthy muscles, and even degenerated and healthy fibres. S. U. L-B.

## *Electro-diagnosis*

**Neri, V.** Signes électriques des lésions du faisceau pyramidal. [**Electrical signs of lesion of the pyramidal bundle.**] *Soc. Med.-Chir. di Bologna,* 1917, April. (*J. d. radiol. et d'électrol.*, 1919, **3,** 381.)

In nervous lesions of central origin, for example, in a hemiplegic, if the nerves and muscles be examined individually, no appreciable modification of the electrical excitability is found, but if a large positive electrode be placed on the nape of the neck of the patient and his hands be placed in a negative basin of water, and then the current be passed progressively, it is found that the diseased member behaves differently from the healthy one. On the healthy side there is flexion of the fingers and of the hand; on the diseased side extension of the fingers and hand is noticeable; it is the extensor phenomenon of Neri, and depends upon exaggeration of the medullary reflex. Galvanic and faradic hydro-electric excitation of the foot also provokes reactions indicative of changes of the pyramidal bundle. Extension of the diseased foot is slow and difficult. S. U. L-B.

# MEDICAL SCIENCE

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# REVIEWS

## TYPHUS

**Epidemiology.** According to Gérard the epidemic of typhus among Serbian soldiers at Bizerta in February–May 1916 was mild, and very rapidly controlled, owing to proper organization and immediate prophylactic measures. The number of cases was small, and the mortality was not as high as 9 per cent. On the other hand, the Roumanian epidemic in January–June 1917, in Moldavia, was remarkably severe, and attended with a high mortality, as the conditions for resisting the disease were very unfavourable. The retreat of the Roumanian Army and the severity of the weather prevented the proper precautions being taken on the appearance of the first cases. The destruction of lice was almost impossible. Although complete statistics for the Roumanian epidemic were not available, Gérard thinks that the mortality was probably even higher than that in the epidemic in Serbia in 1914–15. It was particularly heavy among the intellectual classes, especially medical men, as 350 deaths from typhus occurred among 1,500 medical officers in the Roumanian Army. The difference in virulence between the epidemic in Bizerta and that in Moldavia is to be explained by the fact that the outbreak at Bizerta was merely a recurrence of the disease, whereas the epidemic in Moldavia was the first visitation of typhus to that country.

In the report of the Inter-Allied Commission to Poland which was appointed by the League of Red Cross Societies to visit that country last August, it is stated that in the first half of 1919 almost the entire country was infested by the disease. The east and especially the south suffered the most, i. e. Volhynia and Galicia, but the prevalence in the south-west of ‘Congress Poland’ was also exceptionally heavy. In ‘Congress Poland’ from January 1, 1919, to July 27, the number of cases declared was 124,620 with 9,657 deaths, a mortality of 7 per cent. The epidemic showed a rising curve from January to April, becoming practically stationary from April to June, at which time it began to decline. In Galicia, where the statistical information was specially reliable, owing to the longer and better organization of the public health service, the cases reported from January 1, 1919, to July 27 were 21,208 with 2,812 deaths, a mortality of 13·26 per cent. In general, the case mortality at all ages seemed to have been from 6–14 per cent. in the civil areas and to have rarely exceeded 9·4 per cent. in military communities. The epidemic therefore was of a much milder type in Poland than that in Serbia in 1914–15, when the mortality was as high as 30 per cent. The commission, however, points out that the epidemic is still continuing, as typhus is being constantly introduced into Poland from the east by refugees, prisoners of war, and the repatriated, and that very severe epidemics will occur in the winter unless most energetic measures are taken to deal with the situation.

**Aetiology.** Rocha-Lima (1) is opposed to the view held by French and English writers that the louse remains a carrier of the typhus virus for 12 days only. His experiments have shown that the louse retains the virus in an active form until at least the 24th day, guinea-pigs contracting the disease after being injected with infected lice, which had been for 24 days on immune persons who were not suffering from typhus. As the result of this experiment Rocha-Lima was convinced that a louse which had once been infected retained the virus throughout its life. Healthy immune persons thus obviously play an important part in the dissemination of typhus by being carriers of virulent lice. If lice were harmless 12 days after they had been infected, the introduction of typhus into remote districts and infection of persons who had not come in contact with cases of typhus would not be so common.

Mueller and Orizio carried out the following series of experiments in order to decide whether the infectivity of the louse is located as in relapsing fever merely in the body cavity or in the intestinal contents as well, and also to determine whether it was possible for the virus of typhus to be transmitted without direct passage of an infected louse to a healthy person but by mere contact of the faeces of the infected louse and scratching of the skin. Thirty lice enclosed in small wooden boxes were attached to the arm of a typhus patient for two consecutive days. They were then fed once or twice a day with the blood of convalescents for 10 days and placed in a test tube, where their faeces were collected at the end of two days. Intraperitoneal injection of an emulsion of faeces into guinea-pigs and rubbing the faeces on their scraped skin reproduced the disease in these animals. During the experiments both the writers pricked their fingers with the syringe containing the faecal emulsion. Seventeen days later Mueller developed a typical attack of typhus, whereas Orizio who had had the disease a year previously escaped. These experiments clearly prove the possibility of the transmission of typhus by the faeces alone of infected lice.

A detailed account of Mueller's illness is given by Pepeu, who states that all other sources of infection but the faeces of the infected lice could be excluded. The eruption was very scanty, and there were hardly any cerebral or nervous symptoms of any kind, except a distressing frontal headache. The attack lasted 14 days. The diagnosis was confirmed by a positive Weil-Felix reaction.

Another example of laboratory infection with typhus is given by Rocha-Lima (2), who states that Prowazek himself and a laboratory assistant probably contracted the disease in the same way, namely by contamination of the fingers with typhus virus contained in infected lice.

**The Weil-Felix reaction.** During an epidemic of typhus in the winter of 1918–19 Monziols and Dubourg investigated the Weil-Felix reaction in 19 cases, and found it positive in all, whereas it was negative in 85 normal subjects or in persons suffering from other infections than typhus. Agglutination appeared fairly soon, usually between the fourth and sixth day, and once on the third. It persisted during convalescence and a certain time after recovery. In three it disappeared on the forty-fifth day. The intensity of the degree of agglutination in no way depended on the gravity or mildness of the infection, nor was it modified by serum treatment even when the injections were given intravenously. The writers regarded the test as of special value at the onset of an epidemic or when the symptoms were not characteristic, which was by no means exceptional.

Montefusco, lecturer in infectious diseases at Naples University, had the Weil-Felix reaction carried out in more than a hundred cases of typhus at the Cotugno hospital for contagious diseases, and found a positive reaction in all. On the first examination the reaction was often positive in a dilution of 1 : 100 and the agglutination titre increased during the following days. The reaction was often present in the first week after the rash had appeared, but was never found in the first five days of the disease. It was always negative in other acute diseases except in one case of small-pox, in which it was positive in a dilution of 1 : 100. No relation was found to exist between the severity of the disease and the agglutination titre. Montefusco considers that the reaction is of value not so much for the recognition of atypical forms as for retrospective diagnosis, since the reaction may persist, though in an attenuated form, for several months after recovery. In typical cases, though it may help to confirm the diagnosis, its practical importance is almost nil, as after the appearance of the rash, a time when the reaction first becomes positive, the diagnosis is easily established by the clinical evidence.

Löwy reports a small epidemic of 15 cases of typhus in which the reaction was most frequently negative, although repeated examinations were made of the bile, urine, and faeces. Some of the patients had a typical eruption and conjunctival haemorrhage, and intraperitoneal inoculation of their blood into guinea-pigs reproduced the disease, so that there was no doubt as to the diagnosis of typhus.

In Rosenberg's estimation the value of the Weil-Felix reaction varies considerably according to circumstances. Normally the clinical picture is decisive, and the Weil-Felix reaction is only required for confirmation of the diagnosis. In a very large number of cases the diagnosis can be made from the clinical symptoms alone at a time when the reaction is not obtainable. In some cases, indeed, the reaction is not only considerably delayed, but remains persistently negative. Rosenberg records a typical case of typhus in an elderly Polish Jew, in whom the reaction was consistently negative, though it was performed every eight days during the patient's stay in hospital. On the other hand, he reports a case which ran its course without any rash, enlargement of the spleen, or any other symptoms except a slight rise of temperature, but in which the diagnosis of typhus was made by a positive Weil-Felix reaction. He also relates three cases of dysentery and three of paratyphoid B fever in which a positive Weil-Felix reaction in dilutions of 1 : 100 to 1 : 400 was obtained, although there was no clinical evidence of typhus.

Friedberger and van der Reis found that small doses of killed Weil-Felix bacilli injected subcutaneously or intracutaneously almost always caused an intense inflammation of the skin in normal individuals, and all diseases except typhus, in which the reaction did not as a rule appear at all or was ill-marked. In all cases of tuberculosis there was a delay in the appearance of the reaction. Whereas in normal persons and in other febrile diseases the reaction appeared in two or three hours, in tuberculosis eight or nine hours might elapse before the redness developed. In a number of cases it was possible to make a diagnosis of typhus by the skin reaction, the diagnosis being subsequently confirmed by the clinical symptoms and Weil-Felix reaction. Further investigations on a larger number of cases will be required to determine whether the skin reaction is specific and whether it occurs earlier than the Weil-Felix reaction.

**Morbid anatomy.** In his notes on the histology of changes in the brain in typhus Parodi states that his observations on the whole confirm those of other writers such as Fraenkel, Ceelen, Jarisch and Jaffé (vide *Medical Supplement* 1918, **1**, 249 *b*), with the following reservations : (1) He does not think that the vascular changes observed in the brain are due to a primary lesion of the intima, and in particular to a primary circumscribed necrosis. He does not deny that the virus of typhus may cause changes of a necrobiotic type in the small vessels, but in his opinion they are not constant, and the perivascular changes appear to develop independently of necrobiotic lesions in the vessel walls. (2) He has not hitherto found lesions of a haemorrhagic type in the brain as described by Jarisch. (3) He has not observed any lesions of proliferative endovasculitis as described by Bauer. (4) Polymorphonuclear leucocytes may take part in the formation of inflammatory foci and are often observed in small numbers in the neighbourhood of an area of encephalitis associated with necrobiotic changes in the corresponding capillaries.

**Symptomatology.** Cantacuzène records 15 cases of medical men who, after being bitten by a louse during the epidemic of typhus in Roumania, carefully noted the prodromal symptoms of the disease, to which five of them succumbed. Several of them had a prodromal fever which preceded the initial attack of shivering. The incubation period varied from 7 days (1 case) to 23 days (1 case), 5 had an incubation period of 8 days, 2 of 9, 2 of 12, 2 of 14, 1 of 10, and 1 of 18. Two of the patients were bitten by two lice at the same time. One of these was a man aged 44 whose attack was rapidly fatal, the other was a man aged 26 who had a moderate attack from which he recovered.

Chiari, who has had an opportunity of making a careful study of typhus in the civil population of East Galicia during the last two years, has found that a rise of temperature is fairly frequent during the incubation period. As it was unaccompanied by any subjective disturbance, it was only discovered by taking the temperature daily of persons who were in quarantine. The rise of temperature during the incubation period occurred in cases in which the febrile stage was of normal duration as well as in those with an abnormally short course, and was separated from the true fever of typhus by one or two days of apyrexia. Possibly certain changes in the spleen were responsible for the early rise of temperature, as this organ was more readily palpable in the first few days of the disease than later. A fresh rise of temperature after several days' apyrexia was not uncommon and usually indicated an outbreak of a mixed infection or an exacerbation of a pre-existent chronic process. In many cases, however, no cause could be detected for the rise of temperature, which must then be attributed to the instability of the thermotaxic centre frequently seen after infectious diseases.

The fall of temperature, which, according to the text-books, is almost constant on the fifteenth day, in a large number of cases observed by Artom occurred on the twelfth or thirteenth day ; in many cases defervescence took place on the ninth, tenth, or eleventh day. On the other hand, the fever was not infrequently prolonged beyond the fifteenth day for one or two weeks more, such cases being very frequently associated with severe pneumonia or broncho-pneumonia.

In 23 out of 220 cases of typhus or about 10 per cent. studied by Vittorugo in a prisoners' camp defervescence took place by lysis. The cases presented all the characteristic features of typhus and the Weil-Felix reaction was positive in all in which it was performed. In a very few instances instead of the ordinary branny desquamation the epidermis peeled off in large flakes resembling that of scarlet fever.

Artom draws attention to the *tongue sign* described by Remlinger, which is due to a paresis of the tongue muscles and is present more or less distinctly in all typhus patients. In its most typical form the portion of the tongue chiefly paralysed is the anterior extremity, so that when the patient is told to put out his tongue its tip remains fixed to the floor of the mouth, behind the lower front teeth, while the posterior portion is thrust forward so that the tongue is, so to speak, folded in two.

Paulian classifies the *nervous complications* of typhus into *A*. Central, *B*. Peripheral, *C*. Various.

*A*. Central. (1) Of 49 cases of hemiplegia studied by the writer 26 were on the right and 23 on the left. In only 10 cases was right hemiplegia followed by aphasia. Sensory changes were very uncommon, there being only one case of hemi-anaesthesia on the right and six on the left side. When the hemiplegia occurred during the febrile period, it usually did not appear before the eighth day, in some cases it did not develop till the end of the febrile period (12th–14th day) or till one or two days after the temperature had become normal (15th or 16th day). In most of the cases the hemiplegia was not preceded by a loss of consciousness, coma, or stertor, but the paralysis occurred suddenly without any alarming symptoms, showing that it was due to obliterative arteritis. In some cases instead of a complete hemiplegia there might be limited lesions such as monoplegia or monoparesis. (2) Nuclear and pontine lesions giving rise to crossed paralysis. (3) Psychical disturbances. Most of the mental symptoms seen during or after typhus resemble those of mental confusion and are associated with a state of stupor and oneiric or hallucinatory delirium. The anatomical lesions may be diffuse or circumscribed meningitis, abscess, or infective encephalitis and resemble those seen in general paralysis with an acute course. (4) Cerebellar lesions which are manifested by typical symptoms of inco-ordination. A meningeal reaction was constantly present. (5) Spinal cord lesions, e. g. spastic myelitis, or more or less localized forms, manifested merely by sphincter troubles without any other obvious objective signs.

*B*. Peripheral lesions. Neuritis and polyneuritis were observed in 55 cases, their occurrence and localization being explained by the attitude of the patient in bed, and the injuries to which he is liable during his delirium. Circumflex neuritis on one or both sides and neuritis of the ulnar nerve were specially frequent. Of the 55 cases 54 occurred during convalescence and only one during the febrile stage. In one of three cases of facial diplegia the complication developed nine months after typhus. In a case of right sciatica the symptoms appeared after ten days' convalescence.

*C*. Various nervous complications, such as functional disturbances of walking, 57 cases; functional disorders of the upper limbs, 5 cases; bent back, 7 cases; deafness and psychical deaf-mutism, 11 cases; tremors, 7 cases; disturbance of vision, 2 cases. Almost all the cases with nervous complications showed temporary or permanent inequality of the pupils probably due to a basal meningitis which is very frequent in typhus.

In examination of 244 cases of typhus Arnold found *optic neuritis* in

144 or 59 per cent. It was a late symptom not infrequently making its first appearance when the eruption had completely or almost completely faded. If an examination of the fundus was made at too early a stage, a negative result would be obtained. In a large proportion of the cases a rapid and complete subsidence of the neuritis occurs after the temperature has become normal. Not infrequently, however, the symptoms persist, especially in cases in which there have been pronounced changes in the papilla. Arnold has seen a few instances in which optic neuritis was still present two to three months after an attack of typhus. The complication occurs most frequently in children and up to middle age; after 50 it is much rarer. This fact is undoubtedly connected with the asthenic course of the disease in later life, as it is usually absent in asthenic attacks in young individuals.

Morawetz records a case of typhus *encephalitis* in a woman aged 26 which developed two days after the temperature had become normal. Apart from catarrh of the left lower lobe no complications had occurred during the febrile stage. The encephalitis was characterized by right hemiplegia, motor aphasia and left-sided apraxia, representing an extensive subcortical encephalitis of the left cerebral hemisphere and middle portion of the corpus callosum. All other factors such as arteriosclerosis, syphilis, and nephritis could be excluded.

According to Vuillet cardiac complications were extremely rare in the epidemic of typhus in Roumania during the campaign of 1916–17. Nervous symptoms on the other hand were important and frequent. The disease nearly always first appeared in the form of acute meningitis (headache, contractures, Kernig's sign, and constipation), and then after about a week the nervous symptoms progressively disappeared, or, on the contrary, the higher centres became affected; delirium became well marked and was accompanied by myosis, dysphagia, trismus, and inability to protrude the tongue. Finally the pulse became quickened and dyspnoea urgent, as in the terminal period of severe pulmonary complications, although stethoscopic signs were absent or only slight. On post-mortem examination the brain showed congestion, diffuse oedema, and dropsy of the ventricles, while the lungs and heart usually appeared normal.

Ganter describes a peculiar form of respiratory disturbance in typhus which occurred in a woman aged 27 and was characterized not only by the irregularity in the succession and size of the individual respiratory movements, but also by the abnormal relation of inspiration to expiration, the latter being abnormally rapid so that inspiration and expiration appeared symmetrical. Expiration was not passive but active, owing to involvement of the expiratory muscles. As the patient's condition improved, the respiratory symptoms decreased and on discharge from hospital had completely disappeared. There were no changes in the lungs or respiratory tract, and lumbar puncture showed that there was an absence of meningitis. Ganter attributes the condition to the specific vascular changes occurring in the brain in the course of typhus (vide Jaffé, *Medical Supplement* 1918, **1**, 249 *b*), and which have their site of predilection in the region of the floor of the Aqueduct of Sylvius. A vessel in the region of the respiratory centre was probably affected, but the lesions could not have led to destruction of the ganglion cells or complete recovery would not have occurred.

**Cerebrospinal fluid.** Rothacker found that the pressure of the cerebrospinal fluid in typhus is usually not raised above 120 mm. of water. The albumin content is only slightly increased. Nonne's reaction is almost always negative. There is always a great increase in the cellular elements and a great variety in the cells, small and large lymphocytes and polymorphonuclear neutrophils being represented.

Monteleone alludes to the investigations of previous writers such as Heuyer (vide *Medical Science,* 1919, **1**, 35), on the cerebrospinal fluid in typhus and records his own observations. He comes to the conclusion that examination of the spinal fluid may furnish valuable diagnostic information, viz. increased tension, excess of albumin with pleocytosis, and absence of Nonne's reaction (presence of globulin). Further investigations will be needed to show the frequency of the Weil-Felix reaction in the early stages of the disease. In three out of seven cases examined by Monteleone it was positive simultaneously in the blood serum and in the cerebrospinal fluid.

**Blood.** According to Rothacker the blood picture of typhus is not typical and varies in all three stages of the disease. Even in the same stage, entirely different appearances in the blood will be met with according to the severity of the attack and the reaction of the patient. In the influenzal stage, which occupies the first four days, the blood picture is generally normal. In toxic cases, however, juvenile forms and irritation forms are considerably increased. Eosinophils are scanty. In the eruptive stage though the total number of leucocytes remains normal, the relative percentage of the polymorphonuclear leucocytes is increased. Eosinophils are absent. From the tenth day onwards the blood picture entirely changes. The total number of leucocytes varies: it is usually between 10,000 and 14,000, and often between 6,000 and 8,000, but rarely below 6,000. It is entirely independent of the severity of the disease. From the tenth day onwards the relative number of leucocytes is constant in all cases; the polymorphonuclears are 95–97 per cent., of which often 10–15 per cent. are transitional forms, large mononuclears, and juvenile forms. Myelocytes are scanty. The normal full-grown neutrophil leucocytes remain in about the same number throughout the disease. Lymphocytes are as low as 3–6 per cent. Eosinophils are absent. The red corpuscles often number only 2–3,000,000. The haemoglobin is normal. This blood picture remains about the same until the temperature becomes normal. In convalescence the total number of leucocytes often shows a considerable increase. Eosinophils reappear, pathological forms disappear and lymphocytosis occurs. By the eighth to tenth day of convalescence the blood picture is normal again. Döhle's inclusion bodies are found as in scarlet fever. Rothacker emphasizes the fact that the blood picture does not possess any diagnostic value before the tenth day at the earliest, and that it is impossible to make a diagnosis of typhus from a specimen of the blood alone, as similar findings occur not only in many septicaemic diseases but also in small-pox.

**Prophylaxis.** Zeiss inoculated 225 men exposed to typhus with defribinated blood taken from typhus patients, as had been previously done by Möllers and Wolf (vide *Medical Science,* 1919, **1**, 37), and others. In 142 cases, 76 of which were in soldiers and 66 in civilians, exact reports were available. None of the army cases contracted typhus during the course of a year, although they were constantly exposed to severe infection. Of the civilians who had been inoculated three times, two nurses in the Turkish typhus hospital contracted the disease 17 and 28 days respectively after the last injection. One had a typical severe attack and the other a mild attack but with a characteristic temperature chart and a positive

Weil-Felix reaction (1 in 800). Each individual was inoculated with 6 c.c. of typhus patient's blood and 2 c.c. of convalescent blood. The Weil-Felix reaction which was performed in 35 cases was negative in 5 and positive in 30 from 1 : 10 to 1 : 640.

Owing to an outbreak of typhus in a prison Martini injected eight out of 17 prisoners with da Rocha-Lima's sensitized vaccine and only one contracted the disease, but the first symptoms had already appeared two days before the vaccination. Of the remaining nine five developed a more or less severe form of typhus and two died. The experiment, however, was open to criticism as, owing to the forced retirement from Poland at the time of the armistice, no Weil-Felix reaction had been performed on the cases and the patients were not kept under observation a sufficiently long time.

**Treatment.** Cantacuzène, Ciuca, Galasesco and Gérard report their experiences of specific serotherapy in the treatment of typhus during the Roumanian epidemic of 1917. Generally speaking, the results were mediocre and the mortality among cases treated by serum was about the same as that among the controls. The serums employed were derived from three sources: (1) the serum prepared at the Pasteur Institute of Paris by Nicolle's method: (2) the serum of convalescent patients: (3) the serum of convalescents reinforced by inoculation of virulent blood. The total number of cases treated by Nicolle's serum did not exceed 100, and the mortality was 25 per cent. The total amount of serum used for each patient varied from 70 to 160 c.c., some being given 10 c.c. daily subcutaneously until definite improvement set in, others 30–40 c.c. subcutaneously for four or five days in succession, and a third group 40 c.c. intravenously for several successive days. The convalescents' serum was taken from patients seven to ten days after the temperature had become normal, and its sterility tested; it was then mixed so as to obtain a polyvalent serum. 15–20 c.c. were injected intravenously on three successive days. Only the severe cases were so treated, especially those in whom cerebral or bulbar symptoms predominated. Although no marked effect was observed as regards the duration of the disease, the intensity of the fever, or the petechial eruption, the treatment had a very definitely sedative influence on the nervous symptoms. The mortality in cases treated by this method was 25·8 per cent. Convalescents' serum reinforced by inoculation of virulent blood taken from patients during the height of the disease was used only in four cases, each receiving 80–100 c.c. of serum. In three cases defervescence took place by lysis from the 13th–16th day; in the fourth crisis occurred on the 15th day. The reinforced serum therefore had no influence on the duration of the acute stage, nor upon the course of the eruption or temperature. The symptoms constantly observed after injection of the reinforced serum were profuse sweating, disappearance of the headache and pronounced enlargement of the spleen, puncture of which showed an increase of Türck's cells, which are so characteristic of typhus.

Monvoisin treated 29 cases of typhus among the prisoners at Wittenberg Camp in the winter of 1914–15 by intravenous injections of convalescent serum. 1 or 2 c.c. were given at a time and the same patient never received more than 8 c.c. in the course of three days, but on several occasions a second injection of 1 or 2 c.c. was given two days after the first if it had only had a transient effect. The best results were obtained with a serum from a patient who had reached the eighth day of convalescence. Of the 29 cases three died, two from broncho-pneumonia and one from nervous prostration.

Monvoisin's conclusions are as follows: (1) The method is perfectly harmless. (2) It causes considerable improvement which is shown by a fall of temperature, diminution in frequency of the pulse, attenuation of all the symptoms, remarkable improvement of the general condition and an unusually early crisis. (3) It diminishes the mortality, only three deaths occurring among 29 cases at a time when the general typhus mortality in the camp was 30 per cent.

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## DYSENTERY

**Epidemiology.** According to an editorial note in the *Lancet* of October 4, an outbreak of bacillary dysentery was in progress at that date in the urban district of Hayes in the county of Middlesex. There had already been over 30 cases, persons of all ages including infants and those over 60 years having been attacked. No fewer than 10 deaths, chiefly among children had been attributed to the disease. The diagnosis had been confirmed by the Shiga bacillus having been isolated from the faeces. The onset in most cases was sudden and accompanied by a slight rise of temperature and abdominal pain followed by diarrhoea and blood-stained and mucous stools. The duration of the disease varied from a few days to several weeks. The origin of the outbreak had not been ascertained, but it was noted that the country was peculiarly liable to the prevalence of dysentery owing to the large number of recently demobilized soldiers who had suffered from dysentery whilst on active service. Another epidemic which was also probably due to soldiers who had returned from the East is recorded in the *Medical Press* of October 8. During the three weeks ending September 10, 80 cases of bacillary dysentery of the Shiga type were notified to the City Health authorities in Dublin, and two cases in the suburbs. Probably a great many more cases escaped recognition, as the outbreak began at a time when diarrhoea was more or less epidemic. The death-rate was fairly heavy, as in one week no less than four deaths were registered.

Smith examined the stools of 504 asylum patients who had never been out of England for intestinal protozoa. The majority of them were without any record of physical ailments. The commonest illness was dysentery, and 69 of the patients were suffering from or had a record of this disease, 25 had renal diseases, 9 of whom had also acute amoebic dysentery. All the usual protozoa were found in the stools, but the infections were distinctly less numerous than in the asylum patients which Smith had previously examined.

**Symptomatology.** Amoebic dysentery is relatively rare in children, even in tropical countries. Lesné and Ramond report a case in a boy aged 10 who had suffered from attacks of dysentery since the age of 3 years. The child had never left France, and the infection was probably due to the fact that for three months he was under the care of an Egyptian nurse about whom no details could be obtained, but who was probably a dysentery carrier. The true nature of the disease remained unrecognized for seven years owing to the parasites not being found in the stools. When amoebae were at last detected, treatment by novarsenobenzol, emetine and ipecacuanha was instituted and recovery took place. In the subsequent discussion similar cases of indigenous dysentery in children successfully treated by emetine were related by Apert and Barbier.

In 1914 Boeri, professor of medicine at the University of Cagliari published an account of some indigenous cases of amoebic dysentery in Sardinia. Up till then no instances of amoebic dysentery had been reported in Italy apart from a few cases in which the infection had been contracted in the colonies. The number of imported cases greatly increased during the war, but the danger arising from them is less than that caused by a permanent focus of indigenous amoebic dysentery which is still present in Sardinia. The principal clinical features of Boeri's cases were their chronicity and tendency to relapses—one case had lasted 16 years—the not infrequent occurrence of peri- and para-sigmoiditis giving rise to hard irregular growths in the sigmoid, manifestations of suprarenal insufficiency such as low blood-pressure and asthenia, the existence of fever usually of a remittent type in the relapses, the frequency of latent, masked or abortive attacks, and the liability of the condition to be mistaken for intestinal tuberculosis and especially an ulcerative new-growth of the descending colon.

According to McWalter cases showing a mixed infection of amoebic and bacillary dysentery have been fairly common in Mesopotamia and in Egypt. Of 40 cases of dysentery recently under his care at least six showed either a double infection or had previously suffered from a different type of dysentery. As a rule there was a definite history of dysentery said to be bacillary within the previous two years, and the existing attack was shown to be amoebic. More rarely an attack of amoebic dysentery was followed after some months by bacillary dysentery.

Hirschbruch and Forthmann report a case of infection with Schmitz dysentery bacilli in a female laboratory attendant which occurred during the pipetting of a culture. Two and a half days later a mild attack of dysentery developed and Schmitz bacilli were recovered from the stools.

Fischer examined the **blood** of 40 cases of amoebic dysentery with the following results: In uncomplicated cases there was as a rule a moderate hyperleucocytosis chiefly due to increases of the neutrophil cells. The eosinophils were not increased, but were on the average less numerous than in health. The number of large mononuclears and transitionals was not affected. There was no typical change in the blood picture. Fischer therefore concluded that the blood in amoebic dysentery was not of any value for diagnostic or therapeutical purposes.

During an epidemic of bacillary dysentery at Lyons in the autumn of 1917 Martin and Debard observed five cases complicated by **oedema**. With one exception aged 21 the patients were all about 40 years of age. All had hitherto enjoyed excellent health. In all but one the attack of dysentery had been severe. The oedema occurred late in the course of the disease when the intestinal symptoms were subsiding or had completely disappeared. In one case the patient had been on fluid diet since the onset of the disease when the symptoms appeared. In two instances the complication occurred on the resumption of ordinary diet, and the remaining patients had been taking their usual diet for some time when they first developed oedema. The onset of the oedema was always insidious. There was no rise of temperature or change in the character or number of the stools. In one case oedema of the face was the first sign and was followed a week later by ascites. Bilateral hydrothorax and ascites were the first evidence of the oedema in another patient who subsequently showed oedema of the abdominal wall, lumbar region and lower limbs. Ascites was the only manifestation in one case. In two cases the oedema was confined to the lower limbs, commencing on the feet and progressively invading the legs. Albuminuria was inconstant. In two cases it was never present, in one it had only occurred before the appearance of the oedema, and the other two showed slight traces. In every case the oedema was accompanied and followed by polyuria, the average amount of urine being 3–4 litres and in some cases even 5 litres in the twenty-four hours. The polyuria was always accompanied by a great increase in the excretion of chlorides (23–41 gm. as compared with the normal 10–12 gm. in the twenty-four hours). On the other hand, the elimination of urea was generally below the normal. Examination of the blood showed a slight decrease in the normal amount of chlorides. The duration of the oedema in the five cases ranged from eight to twenty-three days. The cause of the oedema was obscure, as none of the patients were suffering from either renal or hepatic disease. In the absence of a more definite cause the writers attribute the oedema to a blood dyscrasia in convalescents from dysentery, as a sequel of the general intoxication.

Kestner and Rennen agree with Rumpel and Knack (vide *Medical Supplement*, 1918, **1**, 97 a) who regarded war oedema as a sequel of chronic dysentery. In 42 cases studied by the present writers examination of the stools showed at one time or another in every case the typical appearances of dysenteric stools, although bacteriological examination was always negative. On the other hand Widal's reaction for dysentery was invariably positive. The post-mortem findings were also decisive, chronic dysenteric lesions being found in the 14 cases in which a necropsy was held. In this connexion it is noteworthy that Oberndorfer on post-mortem examination of cases of war oedema almost invariably found severe inflammation of the large intestine ranging from the ordinary appearance found in dysentery to a gangrenous destruction of the entire intestinal wall (vide *Medical Supplement*, 1919, **2**, 29, *b*).

**Hepatitis and hepatic abscess.** Paisseau and Lemaire have observed a fairly large number of cases of dysentery with signs of hepatitis which showed no tendency to suppuration, even when the symptoms had lasted for several years and no emetine treatment had been adopted. This variety of hepatitis presents other clinical peculiarities. In the first place it is characterized by the predominance of signs of perihepatitis over hepatic symptoms properly so called. Increase in size of the liver is as a rule slight and jaundice is usually absent, whereas the typical signs of subdiaphragmatic perihepatitis are all present. Secondly, signs of a pleuro-pulmonary reaction at the right base are constant. As a rule there is a weakness of breath sounds on auscultation with more or less abundant sibilant râles and frequently some fine crepitations or occasionally a pleural rub. There is also an impairment of resonance which becomes gradually merged in the hepatic dullness, and a more or less definite diminution of vocal resonance. The respiratory signs may become so pronounced that the patients may be treated for several months for chronic bronchitis and emphysema. Thirdly, there are signs of irritation of the phrenic nerve such as pain in the shoulder, dry and paroxysmal cough and the presence of phrenic points over the xiphoid or between the sternomastoids. One of the most characteristic features of this chronic hepatitis is the attenuation of symptoms of infection. The onset is almost apyrexial, and sometimes months may elapse without any considerable rise of temperature. In most cases the temperature is occasionally raised, but hardly ever exceeds 100·4. The absence of suppuration does not necessarily imply that the prognosis is not serious. Although some patients appear to put up with their hepatitis for several years, in the end their general condition begins to suffer, their strength gives way, and progressive emaciation and anaemia ensue. Laboratory methods do not always clear up the diagnosis, as the examination for cysts often proves negative. A rapid method of confirming the diagnosis is the employment of emetine treatment. In less than twenty-four hours there is considerable relief, and the signs and symptoms rapidly disappear altogether. In old standing cases, however, several courses of emetine treatment may be required.

In a series of 15 cases of liver abscess reported by Talbot there were seven outstanding diagnostic signs: general enlargement of the liver (15 cases), pyrexia, continuous or intermittent (15 cases), leucocytosis (14 cases, 1 not examined), a local tender spot over the liver (14 cases), signs of irritation at the base of the right lung (13 cases), rapid wasting (14 cases), heavy sweats (12 cases). The other signs or symptoms of value were local bulging (9 cases), pallor (12 cases), rigors (6 cases), referred pain in right shoulder (6 cases) and rigidity of right rectus. In 3 cases there were multiple abscesses. The average quantity of pus was 8½ oz., the greatest quantity in any case 30 oz. The pus was sterile in 8 cases, contained *E. histolytica* in 3, *staphylococcus* in 3, *B. coli* and *B. pyocyaneus* in 1 case each.

Pontano remarks that though the coexistence of dysentery and the presence of the *Entamoeba histolytica* in the stools or in the hepatic fluid removed by exploratory puncture are sufficient to establish the nature of a hepatic abscess, in some cases these criteria may be absent. In such cases the nature of the fluid removed may serve as a criterion. Just as in the diagnosis of an echinococcus cyst the chemical qualities of the fluid are decisive, even if the hooklets are not present, so in the case of matter withdrawn from the liver, if it is not true pus but a fluid containing cellular débris, red cells, haematoidin crystals or fatty acids, the diagnosis of amoebic abscess can be made.

According to Davies-Colley the abscess is single in about 60 per cent. of the cases, and to find more than three is very rare. In Mesopotamia he found that the proportion of multiple abscesses was rather higher than usual, and suggests that this may account for the high death-rate in that country. Apart from exploratory puncture he regards X-ray examination as by far the best diagnostic guide. The pushing up of the right cupola of the diaphragm, and its lack of mobility as compared with the left during respiration are easily seen on the screen, so that in the presence of free movement of the diaphragm exploratory puncture is useless.

In an article on the **gastric and intestinal sequels** of dysentery Alexander states that achylia which is regarded by several writers, especially Schröder, as the most frequent sequel of dysentery, was not very frequent in his experience, as it occurred in not quite 20 per cent. of his cases either alone or in association with other sequels. A careful study made by Alexander of the gastric disturbances following dysentery by frequent examination of a test breakfast showed that a rapid change occurred in the gastric chemistry. Cases which during the acute stage had a normal acidity, in convalescence presented achylia, which was apparently of a very severe form, but a few weeks later the acidity become normal or in excess, while in others at the onset of convalescence hyperchlorhydria and later achylia might occur and subsequently disappear. In pure forms of achylia there was both an absence of hydrochloric acid and of pepsin, but besides the pure forms of achylia there were transitional forms in which hydrochloric acid was completely absent, though the secretion of pepsin was not completely suspended, and *vice versa* there were cases in which there was complete apepsia but slight traces of hydrochloric acid were present. Apepsia of this kind accompanied with a high degree of achlorhydria, Alexander has frequently seen after dysentery, but it is less refractory to treatment than complete achylia. The most frequent gastric change seen by Alexander was hypochlorhydria and achlorhydria in the form of a severe sub- and anacid gastritis. Most of these cases were accompanied by gastrogenous diarrhoea. Pure hyperchlorhydria in the form of excessive secretion of hydrochloric acid and superacid gastritis was the rarest occurrence. Gastric atony might occur after dysentery as after other infectious diseases, and usually in association with subacidity, but in Alexander's experience it had a rapid tendency to disappear. It usually developed in the acute stage of the disease, but rapidly subsided in the first weeks of convalescence. Alexander did not see any cases of dilatation of the stomach after dysentery, although he met with examples of gastroptosis, but this form of gastric disturbance was always regarded as a consequence of loss of weight and part of a general enteroptosis. Intestinal disturbance might occur by itself as a sequel of dysentery, just as gastric disorder might be an isolated sequel. Catarrh of the small intestine and fermentative dyspepsia might be found in which investigation of the stools showed an enormous amount of undigested starch while the gastric examination showed normal acidity. Such cases, however, were the exception, and as a rule there was also a sub- or anacid gastric catarrh or achylia. It is very important in such cases to make a careful examination of the faeces, as it is essential as regards treatment to know whether there is a fermentative dyspepsia or gastrogenous diarrhoea present. Involvement of the small intestine may be complicated by disease of the bile-ducts which is extremely refractory to treatment. In disease of the large intestine two forms may be distinguished according as they are due to a primary infective or a secondary spastic cause. The latter consists of spastic colitis and mucous colitis which is often associated with hyperchlorhydria and excessive secretion of gastric juice, while the former is manifested by a severe colitis and proctitis with ulceration. Peritonitis due to perforation of the intestinal ulcers is a further sequel of dysentery. It is usually of a local circumscribed kind which gradually subsides, but it may give rise to trouble subsequently owing to the formation of adhesions.

In his Paris thesis on dysenteric appendicitis and pseudo-appendicitis Vives states that true appendicitis may occur in acute dysentery, ulceration of the appendix giving rise to clinical symptoms of appendicitis. As a rule, however, the appendicitis is masked by the dysenteric phenomena or by the symptoms of general peritonitis due to perforation of the appendix. The condition usually is first revealed at the autopsy. In addition to true appendicitis, in cases of chronic relapsing dysentery there is a pseudo-appendicular syndrome characterized by clinical symptoms of appendicitis but without anatomical lesions in the appendix. The condition is probably due to dysenteric lesions in the caecum which are almost constant in fatal cases. Vives has found that both true and false appendicitis are more frequent in amoebic dysentery than in bacillary dysentery or unclassified dysenteries.

Miloslavich reports two cases of post-dysenteric proctitis and peri-proctitis in men aged 32 and 48 respectively in whom the clinical diagnosis was cancer of the rectum. Shortly before death a recrudescence of the dysenteric process occurred in both cases. The writer refers to a similar case reported by Brüning (vide *Medical Science* 1919, **1**, 69), and urges that in all cases of indurative and ulcerative proctitis with a tendency to stricture the possibility of chronic dysentery should be considered.

In a series of 973 cases of bacillary dysentery studied by Klein true dysentery **arthritis** occurred in 8 instances or 0·8 per cent. The knee-joint was involved in every case, and only two had other joints affected, viz., the temporo-maxillary and ankle-joints. The commonest time of onset for the arthritis was about the 20th day. No deformity or thickening round the joint occurred. The only abnormality was marked wasting of the extensor muscles of the thigh and the calf muscles. No dysentery bacilli were found in the joint fluid in the five cases examined.

Of 341 consecutive cases of bacillary dysentery treated by Waller 6 or 1·7 per cent. developed arthritis. The left knee-joint was affected in all cases. The right knee, ankles, and shoulders were involved in 3, the manubriosternal and wrist-joints in 2, and the left hip, sternoclavicular and interphalangeal joints in 1. In all cases a certain degree of thickening and restriction of the movement of the joints persisted when the patients were evacuated from hospital.

In an epidemic of Shiga bacillus dysentery described by Rosenthal arthritis was extremely frequent, especially among the mild cases. (The incidence per cent. is not stated). As a rule only one joint was attacked, occasionally more than one, but the arthritis was never generalized. A few examples of cervical arthritis and involvement of the joints of the hands were seen, but the knee-joint on one or both sides was most frequently affected. The condition was often merely one of arthralgia with painful points on the inner side of the knee, as if the periarthritis was more marked than the actual joint affection. There was also a form characterized by hydrarthrosis without any obvious inflammation. In rare instances a pseudo-phlegmonous form was seen which closely resembled suppurative arthritis, although nothing was found on exploratory puncture. Complete recovery was the rule, and suppuration never occurred. Muscular atrophy did not take place or was only slight.

**Prophylaxis.** Petruschky states that percutaneous inoculation against bacillary dysentery suggested by him in 1914 was first employed in 1917 and 1918 for military purposes. The first occasion was during an epidemic at Marienburg in 1917 when a multivalent vaccine was used containing not only the various organisms of bacillary dysentery but also paratyphoid and Gaertner bacilli. The technique was as follows: From 2–8 drops were rubbed into different healthy parts of the skin, such as the inner side of the forearm or upper arm, with one or two days' interval between each application. It was not necessary to take the temperature as no rise of temperature was caused by the procedure. In a garrison consisting of 3,974 men 380 were given the antidysenteric liniment, and 3,594 received none. The incidence of dysentery among the latter was 1,113 cases, or 31·2 per cent., with 35 deaths, or a mortality of 3·1 per cent., whereas among those who had been rubbed with the liniment only 8 contracted the disease and all recovered. The percentage of cases among the uninoculated was thus fifteen times greater than among the inoculated, and the percentage of deaths among uninoculated was half as much again (3·1 per cent.) as the number of cases (2·1 per cent.) among the inoculated. The second occasion on which the method was employed was during a remarkably severe epidemic of bacillary dysentery in Westphalia in 1918. The exposed garrison was divided into three groups, each consisting of about 1,580 men, the first of which remained untreated, the second was inoculated with Boehncke's 'dysbakta' (vide *Medical Science*, 1919, **1**. 70) and the third with the antidysenteric liniment. The results were as follows: the incidence of dysentery among the uninoculated was 9·8 per cent., of whom 54·4 per cent. died. Among those inoculated with 'dysbakta' 3·6 per cent. contracted dysentery, among whom the mortality was 21·4 per cent., while among those who had been given the antidysenteric liniment the incidence was only 3·5 per cent., of whom 14·3 per cent. died.

Petruschky regards percutaneous in place of subcutaneous immunization as the aim of the future. At his suggestion the following liniments have been composed: Lin. anti-dysentericum, Lin. anti-typhosum, Lin. anti-catarrhale containing antigens against pneumococci, streptococci and staphylococci, Lin. anti-catarrhale cum Lin. tuberculini comp. 1 : 1,000 and 1 : 150, and Lin. tuberculini comp. 1 : 25 and 1 : 5.

**Treatment.** In his notes on the treatment of bacillary dysentery Klein recommends that antidysenteric serum should be given intravenously in large doses—about 60–100 c.c. It is most efficacious when given early. During the first five or six days he found that the serum had a most favourable effect both as regards averting a fatal issue and hastening recovery. When a case had reached an intermediate stage which lasted from the 6th–10th day, it was likely to die or recover irrespective of serum treatment. The rate and completeness of recovery, however, might still be affected by serum, especially if given in large doses, such as 100 c.c. In a third stage, which generally started about the 10th day, serum treatment was practically useless.

Waller treated 148 cases of bacillary dysentery with Lister Institute polyvalent antidysentery serum in addition to sodium sulphate orally and a carefully chosen diet. In fairly severe cases 140 c.c. of serum were given in 3 subcutaneous injections at 8-hourly intervals during the first 24 hours. Less severe cases received 100 c.c. in 2 subcutaneous injections during this period. The results showed that in cases in which serum was used early the acute stage was of shorter duration, the tendency to chronicity less, and convalescence more satisfactory than in cases treated by serum late in the course or by alternative methods.

Among 980 cases of Shiga bacillus dysentery treated by Rosenthal there were only six deaths, a mortality of 0·6 per cent. This low figure was not due to the mildness of the outbreak, as in other units the mortality was as high as 10–15 per cent., but was attributed by the writer to large doses of serum, the systematic use of morphia, regular feeding of the patients as soon as the acute stage was past, and careful nursing. In every severe case 60 c.c. of specific serum was given the first day, and 40 or 60 c.c. on the two following days according to the case. In 48 hours the stools ceased to be haemorrhagic and in four days their number fell from 60 to 15 or 10. If no improvement took place the injections were continued in doses of 40 c.c. a day. In some cases the total amount of serum given exceeded 400 c.c.

Nolf who recently described an epidemic of bacillary dysentery in the Belgian army (vide *Medical Supplement*, 1918, **1**, 116 *a* and *b*) has found specific serotherapy futile and regards vaccinotherapy, especially by the intravenous route, as the most effective treatment both in the chronic forms and in acute forms which show little tendency to recovery. The method is most efficacious when it is applied early. When it was possible to isolate a dysenteric organism from the intestine an autogenous vaccine was employed; otherwise a stock vaccine of the Flexner type was used. The intravenous route had the advantage that doses one thousandth the size of the subcutaneous could be given with good effect. In acute dysentery intravenous vaccinotherapy rapidly cured cases with protracted fever and persistent diarrhoea which were refractory to other methods, including serotherapy.

In a discussion on the posology of emetine at the Société de Thérapeutique of Paris on May 14, 1919, Chauffard stated that in moderately severe cases of amoebic dysentery he was in the habit of giving two subcutaneous injections daily, each containing 3–5 cgm. of emetine hydrochloride. He preferred the subcutaneous as less painful than the intramuscular route, and had never given the drug per rectum, as this method often gave rise to unpleasant symptoms. His patients were given a series of injections for six to eight days followed by a week to a fortnight's rest. The injections were then resumed if amoebae or cysts were still found in the stools.

According to Gouzien, medical inspector of the French colonial troops, although doses as large as 10–15 cgm. of emetine hydrochloride have been given daily without giving rise to any serious symptoms, the dose of 6 cgm. is not as a rule exceeded by medical men in practice in the colonies. He thinks that the daily dose may even be reduced to 4 cgm., which may be given in either of the following ways: (1) for two or three days in succession, and then six days' rest, during a period of several weeks; (2) for five or six days in succession, then a week's rest, and a fresh series of four or five injections followed by a fortnight's rest, and a third series if necessary. The emetine may be resumed if required, two or three months later, and then at longer intervals according to the clinical and bacteriological condition of the stools.

Dopter stated that injections of emetine might give rise to toxic symptoms such as cardiac, digestive and nervous disturbance which might sometimes prove fatal. The toxicity of emetine was favoured by its accumulation in the system and by its slight degree of daily elimination. According to the amount injected the elimination might extend over a period of 40–60 days after the last injection when the patient had been treated daily for eight to ten days. In practice therefore it was advisable not to exceed a total dose of 1 gm. in daily doses of 8–10 cgm. If toxic symptoms developed before the total dose of 1 gm. was reached, treatment should be suspended. If several courses of emetine were required for relapses of amoebiasis, it would be necessary to wait 40–60 days, i. e., the time required for complete elimination of the drug from the first course.

The following method was recommended by Noc from his experience in Cochin China: (1) an injection of emetine hydrochloride in doses of 4 cgm. daily for four days; (2) an intravenous injection of neosalvarsan (0·30 gm.) on the first or second day; (3) small doses of extract of ipecacuanha (5–10 cgm.) three times a week; (4) one or two injections of emetine every week or fortnight according to the frequency of relapses and number of cysts in the stools; (5) re-injection at fairly long intervals of small doses of neosalvarsan (0·30 gm.) concurrently with the injections of emetine.

Boeri found that emetine was much more efficacious in acute attacks than in chronic or protracted forms. He attributes this fact to the lesser resistance and greater sensitiveness to emetine (as to any other drug) of the vegetative amoebic forms which predominate during the acute stage, whereas the cystic forms which are most abundant in chronic dysentery and in the intervals between the attacks are more resistant to emetine.

Carabin devotes his thesis to the description of Carnot's method of administration of emetine per rectum in the treatment of amoebic dysentery. The method consists in the rectal injection of 0·08 gm. of emetine hydrochloride in 100–150 c.c. of agar-agar, the action of which is to retard the rectal absorption of emetine and thereby facilitate a prolonged contact of the drug with the amoebae and the intestinal ulcers. The thesis contains the histories of six cases successfully treated by one or more series of ten injections, one being given daily, and also an account of cases in which the treatment was ineffectual.

In a paper on hepatic abscess before and after the discovery of emetine Gaglio, director of the surgical section of the Italian Hospital Umberto I at Cairo, states that until a few years ago the mortality from hepatic abscess in amoebic dysentery ranged from 40–50 per cent. Since the introduction of emetine in 1912, although the number of patients in the surgical section has increased, the number of operations for abscess of the liver has diminished and the mortality has declined. Thus out of 64 who were operated on for hepatic abscess between 1904 and 1911 35 were cured and 29 died, while out of 31 operated on between 1912 and 1918 24 were cured and only 7 died. The recovery rate has thus risen from 54 to 77 per cent. The use of emetine has also simplified the technique of the operation, the abscess being opened under a local anaesthetic (novocain).

Davies-Colley prefers open operation and drainage through the chest wall to aspiration and injection of emetine because he has seen cases in which the abscess has re-formed after aspiration had been done elsewhere. He is however inclined to think that the more chronic forms of abscess may be successfully treated by aspiration.

Talbot has treated 4 cases of hepatic abscess by open operation and drainage and 11 by aspiration with an ordinary 20 c.c. glass syringe and needle with a fairly large bore which was passed in various directions into the liver until the abscess was found. He does not consider it necessary to withdraw all the pus, but once the tension in the abscess cavity is relieved the emetine-carrying plasma can pass through the walls of the abscess cavity and exert its lethal effect on the amoeba present there.

After aspiration each patient was given a course of hypodermic injections of emetine hydrochloride gr. i. daily for a week and then on alternate days until gr. xii or xiv had been given.

A case of amoebic abscess of the liver cured by emetine and 914 without operation is reported by Chauffard and Françon. The patient, a soldier, aged 25, had never been in the colonies, but had contracted dysentery from contact with black troops near Paris. Although no amoebae or cysts were found in the faeces, the fluid withdrawn from the liver by an exploring syringe presented all the appearances of amoebic pus. The patient was given a daily injection of 8 cgm. of emetine for a week, and a fortnight later 6 cgm. for another week, 5 injections of 914 were also given, the first consisting of 0·15 gm. and the rest of 0·30 gm. According to the writers only 10 other cases of this kind are on record. In a case reported by Mattei 13 days after cure of the hepatic abscess the patient died of pneumonia, and at the necropsy only a trace of the abscess was found in the liver in the form of a caseous mass enclosed in a dense fibrous capsule. Pontaro also records two cases of hepatic abscess which were completely cured by subcutaneous injections of emetine. In a case reported by Silvestri not only was the hepatic abscess cured by emetine but also a subsequent broncho-pneumonia probably due to septic embolism. These cases show that it is possible for a dysenteric hepatic abscess to be cured by emetine without operation, but it should be added that this happy termination is not the general rule and that it cannot be expected in the case of large abscesses.

Emetine treatment, however, should always precede the operation, the success of which it will render more certain by arresting the progress of amoebic hepatitis. The operation will then be carried out under the most favourable conditions, but it will still be necessary. On the other hand, when the abscess is circumscribed and of about the size of a tangerine orange, as it was presumably in Chauffard and Françon's case, medical treatment is able to effect a cure, and an operation should not be performed unless emetine treatment is only partially successful.

Ravaut and Charpin record five cases of chronic amoebic dysentery which after proving refractory to injections of emetine and novarsenobenzol were cured by the buccal administration of a paste containing charcoal, bismuth and ipecacuanha associated with capsules of novarsenobenzol (0·10 gm). The formula of the paste was as follows: charcoal, bismuth subnitrate, glycerine, syrup $\overline{\text{aa}}$ 100 gm. pulv. ipecac 4 gm. If the patient is suffering from violent and painful diarrhoea a little powdered opium may be added. The treatment is carried out as follows: first day, 2–10 tablespoonfuls of the paste are given, second day one or two capsules of novarsenobenzol, third day the paste, fourth day the capsules, and so on for a series of 10–20 days. In none of the patients so treated was any vomiting, nausea, diarrhoea, or colic observed. On the contrary the appetite improved, and the patients gained in weight. Rectal injections of novarsenobenzol may prove a very useful supplement to the treatment. In order that the drug may be retained its quantity should not exceed 0·15–0·30 gm., the amount of water should not be more than 50–100 gm., and a little tincture or extract of opium should be added.

Schiff has treated 50 cases of dysentery, chiefly of the Shiga-Kruse variety with rectal injections of formalin. 300 c.c. of a 1 per cent. solution were given twice daily. When the mucus disappeared from the evacuations and the stools assumed a porridgy consistency, the injections were given only once daily for another week and then discontinued, even if the stools had not become quite normal. In mild and moderate cases blood disappeared from the discharges within the first few days of treatment, and in most of the cases the stools became semi-formed on the 4th–7th day, and regained their normal consistency within a fortnight. Cases in which recovery was delayed were mainly in children who were unable to retain the injections for any length of time. The chief drawback to the method was that it was more or less painful. As a rule, however, the pain only lasted a few days and subsided as healing took place.

According to Muller surgical intervention in dysentery is indicated whenever medical treatment proves inefficacious or in the severe forms of the disease which experience shows are refractory to ordinary treatment. In acute cases the indications for operation are a persistently high temperature, pain on pressure throughout the extent of the colon, and rapid aggravation of the general condition with frequent foetid haemorrhagic stools. In chronic forms of dysentery operation should be performed as soon as cachexia develops. Muller regards caecostomy as the method of choice.

Cotte recommends appendicostomy followed by lavage of the large intestine with 1 : 1,000 solution of silver nitrate in obstinate cases of acute dysentery. He records 7 cases, in all but 2 of which this treatment was successful.

Vives recommends that appendicitis occurring in the course of acute dysentery should be treated surgically so as to avoid perforation, and after the appendix has been removed caecostomy should be performed so as to enable the dysenteric ulceration of the caecum to be treated by appropriate lavage. On the other hand, symptoms suggestive of appendicitis in the course of chronic relapsing dysentery only require operation when they do not yield to the ordinary treatment of dysentery.

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## ALIMENTARY DISEASES

According to Vandenhoof the **coated tongue** gives no evidence of real value as a symptom of indigestion, there being no direct relation between the coating of the tongue and affections of the stomach. An analysis of 1,500 cases in which gastric analysis was made and the accompanying condition of the tongue noted showed that the proportion of clean and coated tongues was independent of the state of the gastric juice. The chief causes of a pronounced coating of the tongue are (*a*) nasal obstruction with mouth breathing such as occurs in fever patients and habitual smokers, (*b*) absence of friction as seen in patients on liquid diet, (*c*) perversion of salivary secretion, which is probably the commonest cause of coated tongue in neurotic individuals.

Ceresole records a case of **chorea of the oesophagus and stomach** in a woman aged 22, who came from an alcoholic and neuropathic family. Since childhood she had suffered from vomiting after food, and the condition had been aggravated by typhoid fever a few months previously. During ingestion of a barium meal the oesophagus showed inco-ordinate and irregular movements, peristalsis alternating with antiperistalsis. The movement had no fixed situation, but might appear at the cardiac end or at the middle or lower third of the oesophagus, never in the upper third. Similar disorderly movements of peristalsis and antiperistalsis were seen when the opaque mass reached the stomach. On the other hand, the progress of the barium meal through the small and large intestine showed nothing abnormal. The issue of the case could not be recorded, as the patient refused further examination or treatment.

**Gastric analysis.** Jacobsen states that numerous and systematic investigations have been made into the nature of gastric secretion in early infancy, but not at a somewhat older age. So before morbid conditions could be investigated, the normal functions of the stomach at this age had to be studied. Ewald's test meals, slightly modified, were given to 25 children without gastro-intestinal disease. It was found that between the ages 1 and 4 years, the secretion of pepsin and hydrochloric acid was less than that of adults, and in about half the number of cases there was no free hydrochloric acid demonstrable by Günzburg's test. The Congo-red and phenolphthalein tests also showed figures below the adult normal. In two cases the Congo-red test was negative. In the second series of cases there were six children between the ages 14 months and 3 years, suffering from acute gastro-intestinal disease. In five cases there was reduced pepsin and hydrochloric acid secretion, and both Günzburg's and the Congo-red tests were negative. In one case in which several test meals were given, the return of the gastric secretion to normal coincided with the cessation of the gastro-intestinal disturbances. In the third series of cases there were 24 children between the ages 1 and 4 years, suffering from subacute or chronic gastro-intestinal disease. In two-thirds of these cases achylia or hypochylia was demonstrable. The secretion of hydrochloric acid and pepsin often became normal as soon as the gastro-intestinal symptoms disappeared. The observations made as to the treatment of gastro-intestinal disturbances in childhood referred mainly to the respective merits of a milk or a milk-free diet. The writer is emphatically in favour of the former.

After many years' experience Meunier has completely given up the ordinary test meal and substituted for it a study of the gastric contents at the end of digestion. The patient is merely given a few stewed prunes after his last meal, the next day he is given a test meal composed exclusively of 30 gm. of mashed potatoes, and four hours later he drinks 10 c.c. of distilled water containing 10 gm. of sugar. Then he lies prone, turning from side to side to mix the contents of the stomach, after which he sits up and the tube is introduced and then he lies down again. The fluid which runs out through the tube is tested for sugar, the dilution of the titrated sugar showing the volume of fluid in the stomach at the time. Meunier declares that when the residue consists merely of gastric secretion, medical treatment only is required, but that residues of food indicate surgical intervention.

**Congenital hypertrophic stenosis of the pylorus.** Pirie suggests that the spasm inducing congenital pyloric hypertrophy is primarily due to hyper-adrenalism before birth. The pyloric obstruction is completed by two secondary influences: (*a*) retention gastritis with consequent swelling of the mucosa, (*b*) added spasm due to several causes, especially phimosis. The final results in the closure of the pyloric orifice are (*a*) absence of acid chyme in the first part of the duodenum leading to (*b*) failure of secretion formation and (*c*) suppression of pancreatic secretion. These factors induce (*d*) inhibition of the normal pyloric relaxation and establishment of a vicious circle.

According to Secchi, who reports a fatal case in a man aged 39, **acute phlegmonous gastritis** is a rare disease, only 104 cases having been recorded up to the present. It appears in two forms; one localized (abscess of the stomach) and the other diffuse. The former is the most frequent. The aetiology is a microbial one; in most cases the condition is due to streptococci, but it is often a mixed infection of streptococci, staphlyococci, and diplococci. The disease may be secondary to infections such as scarlatina, typhoid, puerperal fever, small-pox, tonsillitis, erysipelas and furunculosis, or to gastric lesions due to inflammation, ulceration, cancer, caustics or trauma. But in the majority of cases, as in that described by Secchi, the disease is primary, the patient being attacked without obvious cause while he is in apparently good health. Chronic gastritis and especially alcoholic excess appear to be predisposing causes. Clinically phlegmonous gastritis has no characteristic features. According to Renault an error in diagnosis is almost inevitable. The difficulty in diagnosis is greatest in the diffuse form, as in the circumscribed variety not only is the onset less violent and the course more prolonged, but two valuable signs may be present: a palpable tumour in the epigastrium and vomiting of pus. There is not a single case on record in which the diagnosis of diffuse phlegmonous gastritis during life was confirmed *post mortem*. Cheinisse quotes a case reported by Chvostek in 1877 in which the clinical diagnosis was confirmed by autopsy, but does not mention if the case was an example of the diffuse or circumscribed form. The same writer quotes the case of Klauber's patient in whom a clinical diagnosis was made of diffuse phlegmonous gastritis on account of the general symptoms and particularly the discharge in the faeces and vomit of a large quantity of whitish fluid composed of epithelial cells and leucocytes. The patient, however, recovered and the absolute confirmation of the diagnosis was therefore lacking. As a rule the symptoms are those of acute septic peritonitis. Secchi draws attention to the following two symptoms which occurred in his case. (1) A well-marked muscular contraction localized in the epigastrium and especially in the left rectus, compelling the patient to bend the trunk forward and a little to the left. (2) The cessation of vomiting three days after the onset of the symptoms, notwithstanding the onset and diffusion of peritonitis. The first symptom has been mentioned by other writers and has a certain value without being pathognomonic. It is all the more valuable the earlier it appears and directs attention to the stomach. The second symptom which has not been emphasized by other writers is explained by the fact that the destructive process involves the muscular wall of the stomach. Apart from the general symptoms of infection and peritoneal reaction the clinical diagnosis of diffuse phlegmonous gastritis must rest on the following signs: (1) The naked eye or microscopical appearance of pus and epithelium in the vomit or faeces. (2) Disappearance of vomiting in the course of the disease. (3) Pain and tenderness situated in the centre of the epigastrium with localized muscular contraction followed by forward flexion of the trunk. The prognosis of phlegmonous gastritis is grave, being almost constantly fatal in the diffuse form, and less severe in the circumscribed variety, in which instances of recovery have been recorded after operation, and even without surgical interference after repeated evacuation of the abscess by vomiting. Recovery is even possible in the diffuse form, if Klauber's case can be regarded as such (vide *supra*). Secchi also alludes to a case on which Mikulicz performed laparotomy and found diffuse phlegmonous gastritis which had not perforated. Recovery took place, but in this case also absolute certainty in the diagnosis was lacking. Peritonitis is a constant complication of phlegmonous gastritis. In favourable cases it is localized in the serous coat of the stomach, but it often becomes generalized, and the purulent process frequently spreads to the pleura and pericardium.

**Gastric ulcer and plumbism.** Although numerous allusions are made in text-books to the occurrence of dyspepsia and vomiting as evidence of gastritis in plumbism, no mention is made of severe localized functional disorders of the stomach and particularly of the frequency of ulcers.

Among 48 cases of chronic lead poisoning studied by Schiff 14 or nearly a third showed undoubted evidence of gastric ulcer, 26 had severe gastralgia and pronounced hyperacidity or hypersecretion, 10 of whom had typical symptoms of duodenal ulcer, 7 had symptoms resembling gastric ulcer without disturbance of secretion, and 1 severe cardio-spasm with well-marked secondary dilatation of the oesophagus. These cases prove that in a large number of patients suffering from plumbism symptoms are erroneously attributed to lead colic, whereas they have really nothing to do with it.

Schiff regards the ulcers occurring in plumbism as belonging to the same group as those in tabes and cardio-spasm. In all three conditions the ulcers occur in diseases accompanied by a severe irritative state of the visceral nervous system, which in the case of plumbism is manifested in the form of colic, and in tabes as crises. All three conditions show severe anatomical lesions of the vagus.

Friedenwald reports a case of perforated gastric ulcer in a man aged 51 with formation of subphrenic abscess and finally perforation through the lung with spontaneous recovery. He has collected from literature four similar cases in which perforation of a gastric ulcer was followed by a rupture through the lung.

Braun describes a new sign of **carcinoma of the stomach** which consists in a more or less extensive impairment of the pulmonary resonance in the angle which the diaphragm forms with the vertebral column. Provided that the lung and diaphragm are normal, the dullness is found in this situation on the right or left or on both sides. The sign is not present in gastric catarrh or in gastric or duodenal ulceration, or cicatricial stenosis of the pylorus, but it is always found in cases in which the diagnosis of carcinoma of the stomach has already been made or in which the disease subsequently appears. Braun's observations indicate that the sign is an early one, and is therefore of considerable value as a guide to operation. Further investigations are required to confirm the diagnostic value of this sign, and to show whether the dullness is due to the tumour itself or to collateral oedema, circumscribed exudation or enlargement of the regional lymphatic glands, the last appearing to be the most likely explanation.

According to Loeper (1) **sarcoma of the stomach** was first described by Virchow in 1865, who reported 3 cases. Since then numerous cases have been published, more than 90 having been collected by Michels in his Geneva thesis in 1916. The affection is most frequent in women, especially between the ages of 40 and 60. Loeper estimates that about 2 per cent. of malignant tumours of the stomach belong to this group. Sarcoma of the stomach is often not discovered until the autopsy or an operation, and its symptoms and course closely resemble those of epithelial cancer. A tumour is frequently the first symptom noticed. In 100 cases on record it was present in 90, and in 30 there was no previous symptom. In the other two-thirds it was preceded by anaemia, dyspepsia, and more or less localized abdominal pain. Vomiting occurred in about 10 per cent. Haematemesis was noted in 7 cases. The general symptoms are loss of flesh which may be considerable, and anaemia which varies according to the stage of the disease. The red cells are normal in amount at first, but may fall to 2,000,000, or 1,500,000 towards the close. Fever is rare. The tendency of sarcoma of the stomach is to invade the peritoneum, and in about 10 cases ascites and sarcomatous peritonitis have been recorded. Secondary growths may occur in the spleen, liver, and lung. Five forms of sarcoma of the stomach have been described: (1) An abdominal form which is liable to be mistaken for any abdominal tumour, as there is no clinical evidence of gastric lesions; (2) an anaemic form, simulating pernicious anaemia; (3) a dyspeptic form, characterized by severe dyspepsia; (4) a form resembling ordinary cancer of the stomach; (5) a form resembling tuberculous peritonitis. The diagnosis can only be made by cytological examination of the fluid obtained by lavage. In the round-celled form which is more frequent and malignant than the spindle-celled variety, the cells are larger than lymphocytes, in a better state of preservation than the normal cells of the stomach, and more regular in shape than those of an epithelioma.

A study of the causes of **indigestion** in 2,000 cases by Vanderhoof showed that chronic appendicitis accounted for one-fifth of the cases, or 21·8 per cent., chronic cholecystitis for 11·2 per cent., peptic ulcer for 10·3 per cent., and functional disorders and affections of the kidneys and heart each accounted for another 10 per cent. Cancer of the stomach and intestines showed an incidence of less than 4 per cent. Uncomplicated gastric anacidity was found in 4 per cent. Among the remaining causes were such miscellaneous conditions as pellagra, amoebic dysentery, and malaria, together with focal infections of the tonsils and teeth, cyclic vomiting, intestinal parasites and retroperitoneal sarcoma.

According to Willot the **digestive symptoms due to poison gases** used by the Germans were not observed either in the acute cases of gas-poisoning in which death was due to pulmonary involvement, or in very mild attacks in which as a rule only slight conjunctivitis and tracheitis were observed. On the other hand, the symptoms were frequently seen in moderate cases. Some of the symptoms, such as vomiting, acute gastritis, febrile gastric derangement and jaundice occurred at an early stage, being due to the irritation produced by the gas, or to a general intoxication of the system. The other symptoms which might occur later, viz., appendicitis and dyspepsia due to excess or deficiency of hydrochloric acid, were separated from the acute attack by a variable period of remission. The cases characterized by hyperchlorhydria were particularly obstinate, gastric ulcer being liable to develop. In patients who had previously suffered from gastro-intestinal disorder, such as gastric or duodenal ulcer, or appendicitis, gas-poisoning was apt to cause a recrudescence of the disease.

Loeper (2) states that the symptoms caused by poison gases at the time of absorption or shortly after are chiefly vomiting and haematemesis, but are rather toxic manifestations than evidence of gastric localization. The haematemesis often comes from the oesophagus or pharynx, and the vomiting is of nervous origin and has nothing to do with a lesion of the gastric mucous membrane. The later symptoms which are more important consist of dyspepsia, nausea and abdominal distension. There may be attacks of pain and constant vomiting; haematemesis may also occur. Examination of the gastric juice shows a diminution in the secretion of acid due to the destruction of the mucous membrane. The vomit may contain blood visible to the naked eye, and red cells are always found on microscopical examination of the fluid obtained by lavage, as well as epithelial cells more or less changed in appearance and polymorphonuclear leucocytes. Anatomically the stomach is red and congested and presents erosions, ulcers, and necrotic patches with yellowish exudate. The frequency of sequelae is greater in intoxication by chlorine, in which it is about 30 per cent., than in intoxication by 'pallite', in which it barely exceeds 25 per cent. The symptoms may be classified in two principal groups: (1) a flatulent type, (2) a painful type, the former being characterized by distension, malaise and a feeling of weight after food, and the latter by pain, salivation, nausea and vomiting. The results of gastric analysis vary. Hypochlorhydria is most frequent, hyperchlorhydria being chiefly found in very old cases. Cytological examination shows a profuse desquamation of the epithelial cells and a mixed or polymorphonuclear leucocytosis indicating a persistent infection of the mucous membrane. Though he does not doubt that chlorine, pallite and mustard gas may give rise to late haematemesis, Loeper has never met with a case, and the only example which he had observed of what was probably a cicatrized ulcer was not verified *post mortem* but only suspected from the X-ray appearances.

**Gastric achylia and enteritis.** Bie reports the following case to support the two propositions: (1) Gastric achylia leads to fermentation in the upper part of the small intestine, the contents of which are normally sterile. This fermentation yields germs which induce enteritis and anaemia. (2) If hydrochloric acid be given in large enough doses to sterilize the contents of the upper part of the small intestine, both enteritis and anaemia will be cured. The usual treatment of achylia with pepsin and hydrochloric acid is ineffective because the dosage of hydrochloric acid is inadequate for the purposes of disinfection. The patient was a medical man aged 34, whose achylia had lasted since he was 20. Enteritis and anaemia developed later. Dieting and pepsin-hydrochloric acid treatment failed to relieve his dyspeptic symptoms, and iron, arsenic, albumin-maltose and injections of cacodylate of soda failed to check the progress of the anaemia. On his admission to hospital he was much debilitated. Vomiting, nausea, constant headache, giddiness, palpitation of the heart, lassitude and dyspnoea were some of the conditions noted. The skin was definitely jaundiced, but there was no oedema and no albumin or sugar in the urine. The haemoglobin (Sahli) was 44 per cent., the erythrocytes numbered 2,400,000, the leucocytes 8,750. Wassermann's reaction was negative, the temperature was subfebrile, and Ewald's test meal showed faulty chymification and other signs of gastric achylia. On an empty stomach and through a thin tube, measuring only 6 mm., 1 c.c. of hydrochloric acid in 250 c.c. of water was given once a day. In the course of the following five days, the dosage was gradually raised to 7 c.c. of acid to 500 c.c. of water. Later, as the bulk of this quantity caused some discomfort, 5 c.c. of acid were given in only 250 c.c. of water. Still later, the dosage was reduced to 3 c.c. in 150 c.c. The immediate result of this treatment was a transition from diarrhoea with offensive stools, to constipation which proved very refractory to treatment with enemata and laxatives. Rapid and almost uninterrupted recovery took place, the haemoglobin rose to 85 per cent., the erythrocytes to 5,040,000. He was able to resume his profession, and to take as violent exercise as tennis. In two other cases in which there was gastric achylia and anaemia, but scant evidence of enteritis, this treatment proved useless, though persisted in for months. The suggestion is made that the efficiency of kefir treatment in certain cases of pernicious anaemia is due, not to the action of the germ of kefir on other germs in the small intestine, but to that of the lactic acid in kefir. And if kefir is beneficial by virtue of its lactic acid, the writer's treatment should be more so, for it ensures more accurate dosage and the administration of larger quantities of acid.

Determann points out that cases of persistent intestinal disturbance not infrequently occur, which are merely caused by a too rapid emptying of the stomach contents without any change in the gastric chemistry. X-ray examination shows that the stomach may be completely empty in a few minutes, so that the patients take their food almost directly into their duodenum. This rapid evacuation of the gastric contents is usually caused by a diet of broth and soup continued for an excessively long period, and is aggravated by defective mastication, hasty eating and emotional factors. Treatment should consist in the substitution of a more solid and attractive diet, containing as much albumin and fat as possible, in the practice of mastication, the avoidance of unpleasant emotions and the administration of small doses of opium.

According to Wandel **fermentative intestinal dyspepsia** which was first described about 15 years ago by Strasburger and Schmidt is chiefly characterized by a disturbance of carbohydrate digestion. On microscopical examination of the stools large starch granules are found. The stools themselves are very bulky, being two to three times the size of normal evacuations, have a sour smell, are not formed but of a porridgy consistence, and still show fermentation after evacuation. The gases formed are mainly $CO_2$ and $CH_4$. Mucus is almost always absent from the stools, which are very frequent. The carbohydrate articles of food which the patients are unable to digest are chiefly peas, beans, and war bread which contains such large quantities of bran, and frequently potatoes also. Some cannot even digest rice. Ability to digest albumin is usually retained, while in pronounced cases digestion of fats is impaired. Fermentative dyspepsia is often accompanied with a hyperacid condition of the stomach. Violent intestinal spasm and flatulence may occur, especially at night. In treatment a neutralization of the excess of hydrochloric acid is required. Withdrawal of all carbohydrates from the diet is often followed by marked constipation, Addition of carbohydrates in the form of mashed spinach, swedes, and carrots is indicated, especially as they contain much alkali. Avoidance of fats is desirable.

According to Lemoine cases of **enterocolitis** were remarkably frequent at Lille in young persons of both sexes aged from 15–25 during the four and a half years' occupation of the town by the Germans. The condition could not be attributed to the food, as there was an almost complete absence of the articles of diet liable to give rise to intestinal disturbance and the diet had become almost exclusively vegetarian. Lemoine attributes the condition to the state of uneasiness and moral distress prevalent among the population, especially those of the age liable to be deported by the Germans. In all the cases the intestinal disturbance was closely associated with nervous symptoms such as anxiety, insomnia, melancholy and restlessness, fear of never recovering, and various obsessions. The nervous condition was the cause of a loss of appetite and interfered with the digestive function. It was therefore not surprising that the intestine on receiving food that had not been properly prepared for it by the stomach reacted by constipation or diarrhoea and invariably by abundant putrid fermentation.

**Intestinal spirochaetosis.** During the examination of 142 morbid stools from Annamites, Chinese, natives of Madagascar, and Frenchmen who had lived in the East, Delamare detected in 20 cases a considerable number of refringent and actively motile spirochaetes which were almost as polymorphous as those of broncho-pulmonary spirochaetosis. Subcutaneous injection of the faeces containing the spirilla had no effect on the guinea-pig, and the same failure to reproduce the disease took place after ingestion in the dog. In intestinal spirochaetosis in man there was a transient but definite diminution of the ordinary intestinal fluid. In Delamare's series, as in that of Le Dantec, the fusiform bacillus was constantly absent. On the other hand, association with protozoa such as *Amoebae*, *Trichomonas*, *Balantidium minutum* and *Chilodon dentatus* was found in eight cases. The intestinal spirochaetes so closely resembled those found in the tracheo-bronchial tree that it appeared impossible not to regard them as morphologically identical with Vincent's organisms. The constant absence of the parasites in the blood, urine, and sputum showed that the disease was essentially a local one. Multiplication of the organisms at the site of the lesion, sometimes to an extraordinary degree, and almost always intermittent in character, and their disappearance as healing took place, were features common to intestinal, gingival, tonsillar, and broncho-pulmonary spirochaetosis. The appearance of the stools was as variable as in amoebiasis; sometimes, but rarely, they consisted merely of mucus stained with blood and containing small sloughs, more frequently they were soft and pasty with blood-stained or amber-coloured mucus, in other cases the discharges were diarrhoeic with little or no mucus and in exceptional cases, extremely foetid. Microscopically there was a moderate leucocytosis, but always less than in bacillary or amoebic dysentery. The duration of dysenteriform spirochaetosis did not exceed two or three days, while that of spirochaetosis of the type of ordinary enterocolitis was often prolonged for weeks or months, during which time remissions alternated with relapses.

Latzel alludes to a case recently reported by Luger in which in addition to more or less numerous spirochaetes and fusiform bacilli, intestinal flagellates, especially lamblia, were found in the stools in large quantities. He records a similar case in a soldier aged 23 suffering from acute gastro-intestinal catarrh. Gastric analysis showed a complete absence of free hydrochloric acid and the total acidity was almost *nil*.

**Pyocyaneus enteritis.** Dold refers to his previous paper on pyocyaneus infection (vide *Medical Supplement*, 1919, **2**, 163) and states that he has since observed 11 cases of pyocyaneus enteritis in which the absence of all other known causes of enteritis such as typhoid, paratyphoid, Gärtner and dysentery bacilli and amoebae and the presence of large quantities of *B. pyocyaneus* in the stools and specific agglutination left no doubt as to the aetiological significance of this organism. The appearance of the stools was not typical. In only one case did they present a greenish appearance, in all the rest they were brownish yellow or grey in colour.

Riff brings forward the following arguments in favour of **appendicitis** being due to oxyurids: (1) appendicitis affects all classes of society alike; (2) It is most frequent between 5 and 20, a period of life during which oxyurides are most prevalent; (3) It is very rare in the infant in spite of the frequency of intestinal affections at this age. The relative immunity of the infant is due to its usually being kept clean. (4) Appendicitis has never been seen in a child younger than 21 days, this period being required for an infant infected on the day of its birth to have oxyurides capable of injuring its appendix; (5) Appendicitis is contagious and may affect several members of the same family. In 152 appendices studied at Strasburg before the war and presenting all forms of acute and chronic inflammation Riff found oxyurides in 48 per cent. Since the war he has examined 73 more appendices removed at the Hôpital Trousseau in Paris and found the parasites present in 80 per cent. The fact that some observers have never found oxyurides present in the appendix in a large number of cases is attributed by Riff to the examination having been made after the appendix had been opened by the surgeon and its contents expressed.

Friedman found transitional leucocytosis or an increase in large mononuclears and transitional leucocytes or an increase in either of them in 87 per cent. of cases of chronic appendicitis. On the other hand, there was no transitional leucocytosis in cases with chronic peptic ulcer, cholecystitis, renal calculus or other organic abdominal conditions. A hyperleucocytosis and a polymorphonuclear leucocytosis were not as frequently found in chronic appendicitis as a transitional leucocytosis. The writer regards a transitional leucocytosis as a superior diagnostic guide to the X-ray signs which are supposed to indicate a diseased appendix. The transitional leucocytosis often persists in the blood after an appendectomy has been performed.

**Treatment.** Einhorn (1) has treated 315 cases of peptic ulcer by duodenal alimentation. In 247 the ulcer was definitely localized as follows:

| | Cardia. | Lesser Curvature. | Pylorus. | Duodenum. |
|---|---|---|---|---|
| Males | 10 | 43 | 36 | 65 |
| Females | 14 | 38 | 19 | 22 |

No deaths occurred during duodenal alimentation. Excluding late recurrences of ulcer symptoms after two years the good results were 95 per cent. Including late recurrences and necessary operations after a two years' period of benefit as failures, recovery took place in 90 per cent. Failure chiefly occurred in complicated ulcers of long standing and pyloric and duodenal ulcers with or without recurring haemorrhage. The greatest percentage of cures occurred among ulcers of the cardia and lesser curvature. The period of duodenal feeding was usually two weeks, but could if necessary be longer. During the tube-feeding period the patient had daily eight meals in two-hourly intervals consisting of milk 7 oz., 1 egg and 1 to 2 tablespoonfuls of lactose, besides 1 pint to a quart of saline twice daily, likewise through the tube. As medication subnitrate of bismuth gr. xxx. together with calcined magnesia gr. ii–v t.i.d. was usually given by the mouth in a wineglassful of water for a month or longer. As a rule the patient was kept in bed for the first week, the second week he was gradually allowed up more and more each day. After two weeks of tube-feeding the tube was withdrawn and nourishment given by mouth, at first principally liquids, but very soon semi-solids, and in about three days solid foods. At first the patient was fed every two hours, but as soon as he was on a liberal diet, three ordinary meals and two small meals in between were substituted.

In a paper entitled ' Experiences with duodenal feeding at U.S. Army General Hospital, No. 41 '. Buckstein emphasizes the importance of the drop method of feeding, as the use of the syringe proposed by Einhorn may produce distension, pain, and nausea. The most suitable rate of feeding can be determined only by the study of the individual case. Though no definite feeding formula can be laid down, the average mixture employed by Buckstein contained 150 c.c. of peptonized milk, 70 gm. of glucose, 2 eggs and 40 gm. of butter. In a patient weighing approximately 60 kg., who is at rest, such a mixture given three times a day is sufficient to sustain his bodily requirements. The length of time the tube is allowed to remain must vary with the age and recuperative power of the individual, as well as with the chronicity and severity of the lesion. To determine the effect of treatment the patient is fed by mouth while he is still being fed by tube. When the food by mouth can be increased, one of the feedings by tube is omitted and finally duodenal alimentation is dispensed with altogether, and the tube removed. On the other hand, if pain recurs on feeding by mouth, duodenal alimentation is continued. The exact position of the tube is determined by injecting a suspension of barium through its open end by means of a syringe and taking a roentgenogram during the process.

Gray and Pirie recommend that apart from fulminating cases which demand immediate operation palliative treatment should be adopted in all cases of congenital hypertrophic stenosis as follows: (1) peptonized milk in appropriate quantities; (2) gastric lavage; (3) circumcision; (4) subcutaneous infusion of saline and 2 per cent. glucose when necessary; and possibly (5) administration of chloral hydrate. In the case of very wasted and weakly infants, if there is no relief of symptoms in 48 hours, operation should be performed without delay, but in the majority of cases palliative treatment should be persevered with for from 10–12 days, at the end of which time pancreatic secretion is re-established in successful cases.

Einhorn (2) has devised an intestinal soft rubber tube about the same diameter as his duodenal tube, 15–20 feet long. At one end is fitted a perforated metal capsule with numerous openings. The opposite or outside end contains a stop-cock or an attachment arrangement similar to that of the duodenal tube. Through the entire length of the tube runs a strong braided silk thread (English No. 3). The tube is provided with a hard rubber holder and wound upon a reel in such a manner that the capsule end of the tube and the holder form the free end on the reel. The capsule is put into the pharynx after a light breakfast and the patient is given water to drink. The reel is kept in a pocket not far from the mouth and the tube is unwound from the reel. X-ray pictures are taken or fluoroscopy practised every two hours during the day till the capsule appears in the duodenum, or later in the caecum. After the examination or therapeutical measures have been finished, the tube can be withdrawn through the mouth or made to go through the rectum after the hard rubber end-piece has been cut at the lips. The tube can be employed for the following purposes: (1) It shows the course of the duodenum and small intestine and is thus of diagnostic help; (2) It enables the physician to instil fluids (nutriment or medication) at any place along the small intestine and probably also at the caecum.

Since 1916 Hoke has made an extensive use of camphor as symptomatic treatment in various forms of meteorism and tympanites. It is given in the form of spirits of camphor in doses of 10–25 drops several times a day. He has also found it very efficacious in cases of chronic plumbism with colic.

In some severe forms of spirochaetosis Delamare found that definite sterilization of the intestine was effected by 2 gm. or 2·50 gm. of 914; in mixed infections of amoebiasis with spirochaetosis 20 or 24 cgm. of emetine were sufficient to cause disappearance of both parasites.

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# DISEASES OF THE LIVER

Under the name of **hepatic spasm and hypersecretion** May describes a condition of which the symptoms are sudden pain of a mild character beginning in the right hypochondrium, becoming more intense, finally reaching an intensity sufficient to incapacitate the patient, and radiating towards the appendix; occasional nausea, more or less marked gas formation with eructations and flatus, and occasional attacks of vomiting when bile and gastric contents are evacuated. Jaundice occurs in the more severe attacks. The blood may be normal or show slight anaemia. The aetiological factors are similar to those of cardiospasm and pylorospasm and are likely to be of nervous origin. May has only seen the condition in persons over 40 years, but it probably occurs at an earlier age. It is liable to be confused with cholecystitis, cholelithiasis, cholangitis, duodenal ulcer, duodenitis or 'pressure' tumour, but is distinguished from them by its transitory nature and negative X-ray findings.

In an article on heredity in the aetiology of atrophic **cirrhosis of the liver** Tiraboschi states that in certain families he has seen two or even three cases of definite cirrhosis, and in two families consisting of 26 members six cases, although the patients were not alcoholic and were not living in a malarious district. Although he does not regard cirrhosis of the liver as a familial disease, Tiraboschi considers that among its predisposing causes an important place should be assigned to heredity.

The importance of syphilis in the aetiology of cirrhosis of the liver was emphasized by Letulle and Bergeron, who found that out of 154 cases of alcoholic cirrhosis at the Hôpital Beaujon 74 gave a positive Wassermann reaction. Courtois-Suffit and Giroux now report four cases admitted to hospital for alcoholic cirrhosis who all gave a positive Wassermann reaction. Specific treatment was adopted and all recovered. The writers' conclusions are as follows: (1) In every case of cirrhosis of the liver with ascites one should think of the possibility of active syphilis. (2) In the absence of a positive Wassermann reaction, even after reactivation, methodical and prolonged treatment should be employed as the patient has everything to gain by it. (3) The improvement is very slow in some cases, and before concluding that the treatment has no effect, it should be continued for several months. (4) Some cases of cirrhosis with a positive Wassermann reaction in the blood and ascitic fluid do not improve in spite of antisyphilitic treatment because it has been instituted too late.

On the other hand, Dufour and Le Hello emphasize the fact that curable ascites is not always due to syphilis, but may be caused by alcoholic cirrhosis. They report two illustrative cases of recovery from ascites secondary to alcoholic cirrhosis after evacuation of 160 and 400 litres of fluid respectively. The patients had not had any antisyphilitic treatment. There was no history of syphilis, and the Wassermann was negative in one, and had not been performed in the other.

Hepatic cirrhosis due to kala-azar was described in 1908 by Leonard Rogers, who found slight or advanced lesions of this kind in about 25 per cent. of all cases. Owing to the rapidity of its course infantile kala-azar is not accompanied by cirrhosis, though it is possible that this complication might develop when the disease assumes a less violent character or when it is arrested by treatment. From examination of specimens taken from adults in India Nattan-Larrier found that the fibrosis resulting from chronic kala-azar may be insular or diffuse; in the latter form there is a fine peri-capillary fibrosis like that seen in the unicellular cirrhosis of congenital syphilis. The Leishmann bodies are seen in the fibrous tissue, and on this account their pathogenic responsibility appears to be established.

According to Fischer, who was recently attached to the Pathological Institute of the German medical school in Shanghai, cirrhosis of the liver is a fairly frequent disease in China. Statistics recently published by Hedblom show that out of 15,793 patients who had been treated in hospitals in China 85 or 0·55 per cent. had diseases of the liver, and of these 43 per cent. were diagnosed clinically as cirrhosis. This is a considerably higher percentage than what would have been expected from one's experience in Europe. Moreover, in addition to the cases of cirrhosis diagnosed as such, there were 203 cases of diseases of the abdomen and peritoneum. 70 per cent. of them were diagnosed clinically as ascites, a large proportion of whom must undoubtedly have been examples of cirrhosis of the liver. Fischer reports several cases on which he performed the autopsy to show that cirrhosis of the liver in China is not due to a single cause but is probably due to a greater variety of causes than in Europe. One was an example of recent cirrhosis following severe small-pox in a woman aged 29. Up to 3½ months before death, when she contracted small-pox, she had been quite healthy, and other factors, especially alcoholism, could not be incriminated. In another case of cirrhosis which occurred in a man aged 40, typhoid fever was the only cause discoverable. Fischer is of opinion that a large proportion of all cases of cirrhosis of the liver in China are due to the *Schistostomum japonicum*. In such cases the diagnosis can be made during life by microscopical examination of the stools, which show the characteristic ova of the parasite. Infection with *Distoma hepaticum*, which is very prevalent in China, may also give rise to cirrhosis. The anatomical changes in the liver in such cases correspond to those of biliary cirrhosis as the parasites are situated in the bile-ducts and the inflammatory process spreads thence to the liver tissue. Clinically, jaundice is much more marked than in atrophic cirrhosis. The correct diagnosis in these cases can also be made by examination of the stools. Although many writers regard malaria as a cause of cirrhosis, Fischer maintains that no undoubted case of true cirrhosis of the liver has yet been proved to be due to malaria. The occurrence of tumour formation in a cirrhotic liver was found in two cases, one being an example of a large adenoma and the other of a primary carcinoma. In neither case was there any parasitic infection of the bile-ducts which Fischer suggests as a possible cause of tumour formation in a cirrhotic liver.

Glaus records a case of isolated **miliary tuberculosis of the liver** in a man aged 80, in whom the clinical symptoms were those of arteriosclerosis and a terminal double hypostatic pneumonia. The necropsy showed a chronic caseous tuberculosis of the pancreas involving the splenic vein. The venous tuberculosis had led to an extensive acute miliary tuberculosis of the liver without general tuberculosis, the liver acting as a filter. The isolated miliary tubercles which were found in the spleen could be explained by retrograde embolism from the splenic vein or by direct propagation of the tuberculosis of the pancreas to the spleen. The other tuberculous lesions found in the patient were a slight chronic nodular tuberculosis of the lungs, slight intestinal tuberculosis and a relatively recent involvement of the peritoneum. In the postscript Glaus relates a similar case in which the liver served as a filter. Death took place after an illness of an obscure nature, and post-mortem examination showed extensive tuberculosis of the bronchial, cervical, portal, and retro-peritoneal glands, nodular caseous tuberculosis of the spleen, and miliary tuberculosis of the liver which was found to originate in the walls of the splenic vein. The lungs, however, were quite free from tuberculosis except a small calcified area at the right apex.

Morrow and McKinistry report a case of primary **sarcoma of the liver** in a man aged 42, who died after about a year's illness. Microscopical examination showed the growth to be a mixed-celled sarcoma of an alveolar type. The rarity of the condition is shown by the fact that not a single case was met with at Guy's Hospital during the 20 years 1870–1889 inclusive (Hale White). Byrom Bramwell and Leith in 1897 were able to collect only 25 cases and concluded that only a few of these could be regarded as genuine. Vecchi and Guerrini examined 45 published cases and accepted only 21 as being undoubtedly primary sarcoma of the liver. Pepere also tabulated a list of 45 cases, and Rolleston collected 32 cases in adults.

Foote summarizes the histories of 10 cases of haemangio-endothelio-sarcoma of the liver which he collected from the literature, including one of his own. He defines the condition as a congenital disease, manifesting itself by an enlargement of the liver and some digestive disturbances within three months after birth, and caused by rapid proliferation of the liver capillaries which leads to the formation of nodules on the surface of and within the liver with a rapid increase in its size. Death usually takes place before the sixth month as the result of pressure and obliteration of the liver tissue. Jaundice and ascites are unusual, and metastases are not found. Histologically the liver shows an infiltration of the more normal areas with small round cells. In places the liver cells are distorted, atrophied and vacuolated. The interlobular connective tissue is increased. The smaller blood-vessels are choked with large endothelial cells, some showing mitotic figures. The nodules are surrounded by a fibrous band of compressed liver tissue, which in some places shows lacunae containing degenerated liver cells. The larger nodules are packed with large round or irregular cells with large nuclei. Giant cells and polymorphonuclear leucocytes are seen in some areas. Haemorrhagic areas are also present in some fields.

According to Pagniez the form of **spirochaetosis ictero-haemorrhagica** seen in France is not characterized by the profuse haemorrhages which occur in Japan, so that the term 'spirochaetosis icterigenes' is more suitable. In 43 cases observed by the writer, epistaxis occurred in 22, but in only six was it repeated and required plugging of the nostrils, and in two it was an element of gravity by itself. The other haemorrhages observed were haemorrhagic herpes in two cases, and slight intestinal haemorrhage, haemoptysis and bleeding from the gums in one case each. Haemorrhages therefore in spirochaetosis icterigenes, as seen in France, occur practically only in the form of epistaxis, which is almost constant in severe forms, but is rarely itself of a grave character. Pagniez has found that the haemorrhages in spirochaetosis are related to important changes in the blood, viz., prolongation of coagulation time, plasmatic type of coagulation, irretractility of the clot, and especially a considerable diminution in the number of the blood-platelets. The fall in the number of the blood-platelets associated with irretractility of the clot is so frequent in spirochaetosis icterigenes that it may be regarded as an actual symptom of the disease. It appears at the onset and is independent of the icterus, so that its presence at a time when the diagnosis is still uncertain is in favour of spirochaetosis icterigenes. The fall in the number of the platelets is shown by such low counts as 30,000,000, 20,000,000, 10,000,000 or even less; whereas their normal number is 200–300,000,000 per cubic mm. There is no diminution in the number of red cells or leucocytes, but rather a more or less marked leucocytosis. The diminution in the number of platelets is only temporary, and they soon begin to increase in number more or less rapidly. Diminution in the number of platelets and irretractility of the clot are constantly present in cases in which epistaxis is profuse, and it is logical to suppose that the disappearance of most of the platelets is largely responsible for the haemorrhage. In some cases, however, in which there are no haemorrhages, diminution in the number of platelets and irretractility of the clot are present. It must, therefore be admitted that the pathogenesis of these haemorrhages is only partly understood and that independently of the lesion in the blood, which causes disturbance of coagulation, there is also a vascular lesion.

The haematology of spirochaetosis ictero-haemorrhagica is also discussed by Garnier and Reilly (1) (2) (3), whose observations may be summarized as follows:—

Clinically one finds an initial anaemia of slight degree. This may be due to the various debilitating influences to which a soldier is exposed, but it is accentuated during the septicaemic or pre-icteric stage by the deglobulizing influence of the causative organism. In this respect the spirochaete of Inado and Ido resembles most other members of the class. With the appearance of jaundice this septicaemic stage seems to come to an end and the anaemia is for the moment stationary. But there follows a fall in the resistance of the red cells, an exaggerated haemolysis and a persistent anaemia. This may last for two or three months and the writers were unable to follow the process of restoration to normal in hospital. Certain changes in the leucocytes are also present. In the febrile stage there is a leucocytosis of from 15–20 thousand. The cessation of pyrexia is accompanied by a fall or even by leucopenia, but relapse is accompanied by a second rise. The leucocytosis is characterized by a very marked tendency to myeloid reaction. There may be present both neutrophil (up to 10 per cent.) and eosinophil myelocytes and Türck's cells are often present. This tendency is present far into the convalescent period and is then accompanied by a slight eosinophilia.

The examination of the marrow, glands, and spleen throws some light on the causation of the initial and subsequent anaemias. In the early stages there is a myeloid reaction such as is met with in many infections, there is already some defect of red cell formation and endothelial proliferation. In the later stage there is still further diminution of red cell formation, the myeloid reaction tends to be replaced by cells such as are met with in chronic inflammations, and there is a great deal of pigment, mostly contained in endothelial macrophages. The spirochaete can be detected in the tissues of the marrow. The spleen showed an intense macrophagic reaction in some of the early cases and seemed on the whole to be complementary to the marrow in this respect, activity of the one corresponding to relative quiescence of the other. Later in the disease, when the patient is perhaps recovering, the spleen enlarges and a true fibrosis of the reticulum appears—the 'sclèrose hypertrophique pulpaire' of Gauckler. In general the lymphatic glands show nothing but slight over-activity of both follicles and sinus cells. There is no phagocytosis.

The writers have also investigated the coagulability of the blood and the resistance of the red cells to saponin and saline haemolysis. The coagulability is little altered at any stage of the disease. In the pre-icteric stage fragility of the red cells is normal, but with the appearance of jaundice it is noticed that the cells become more resistant to haemolysis. In those who are destined to suffer from the later severe and long-continued anaemia this increased resistance is followed after the cessation of pyrexia by a definite increase of the fragility. The writers are inclined to attribute this to the action of the spirochaetal toxin acting through the lipoids and neutral fats of the diseased liver, and consider the resulting anaemia analogous to that of toluylendiamine poisoning. These researches may therefore be summed up as follows: So long as the spirochaete is in the general circulation (the septicaemic stage) there is a direct action on the red cells which causes them to become the ready prey of phagocytes. With the onset of jaundice the septicaemic stage ends and the parasite is now relatively fixed in the tissues and has no further direct action on red cells. It has, however, a very evident action on the haemopoietic tissues, inducing changes comparable to those found in any 'granulomatosis'. Red cell formation is hindered thereby and a somewhat characteristic myeloid reaction appears. The marrow was only examined by means of smears so that it is possible that it was more fibrosed than appears, but it is certain that the spleen is involved in a hypertrophic cirrhosis, such as may be met with in various chronic infective conditions. The effect on the liver is such as to produce jaundice. This in turn raises the resistance of the red cells and hinders haemolysis. But at a later stage the jaundice grows less and the degeneration of the liver produces bodies of a lipoid nature which are destructive to red cells in the sense that they render them more fragile. There then results an anaemia in many respects, but not in all, comparable to that seen in haemolytic jaundice of the family type. This is only recovered from—if indeed it does not prove fatal—when the liver has regained its normal function.

Da Matta, who has seen many cases in Brazil, suggests the substitution of the term hepato-renal spirochaetosis for spirochaetosis ictero-haemorrhagica, as the spirochaete of Inada and Ido may give rise to clinical forms which do not always show either haemorrhages or jaundice. He has employed with advantage intravenous injections of urotropine. The solution, which must be freshly prepared, consisted of 2 gm. of urotropine dissolved in 15–30 c.c. of distilled water as a daily dose. The action of urotropine, according to the writer, is as follows: (1) it sterilizes the bile and promotes its elimination; (2) it disinfects the gastro-intestinal canal, liver, and urinary tract; (3) it increases the amount of urine and substances excreted; (4) by its antiseptic and bactericidal properties it destroys the pathogenic organisms. There are no contra-indications to its use, even in affections of the kidneys, liver, and circulatory and nervous systems. The treatment should be continued for a definite period and should not be given up when recovery is beginning to take place.

Villaret, Benard, and Dumont describe a case of spirochaetal jaundice contracted in Paris which resembled cholelithiasis in the pronounced character of the jaundice, the enlargement of the liver and spleen and painful distension of the gall-bladder. The clinical symptoms and temperature chart were not characteristic of spirochaetal jaundice, and the serum showed an absence of agglutinating power even at an advanced stage. The true nature of the disease, however, was shown by the positive result of inoculation of guinea-pigs and the immunizing action of the serum.

Garnier and Reilly (4) describe four fatal cases of severe jaundice which proved to be due not to spirochaetosis ictero-haemorrhagica but to **acute yellow atrophy of the liver.** They point out that the clinical picture of acute yellow atrophy differs from that of spirochaetosis ictero-haemorrhagica in the fact that the malignancy of the latter condition is due mainly to renal insufficiency, as is shown by the considerable diminution or even complete suppression of diuresis. The symptoms are those of uraemia. The jaundice progressively increases and attains a considerable intensity. The cerebrospinal fluid usually contains an excess of leucocytes. Death takes place as a rule between the eighth and thirteenth day of disease, three to six days after the onset of the jaundice. There is a striking contrast between the patient with spirochaetosis ictero-haemorrhagica who realizes the gravity of his condition and the patient with acute yellow atrophy who becomes comatose with the onset of jaundice. In the former the jaundice becomes rapidly intense, in the latter it is slight; the former has oliguria or anuria, while in the latter diuresis is normal. The two diseases can also be distinguished haematologically. In spirochaetosis ictero-haemorrhagica leucocytosis is constant, and is chiefly caused by an increase in the polymorphonuclears which in fatal cases constitute 93–97 per cent. of the total number of leucocytes. On the other hand, in acute yellow atrophy leucocytosis is ill marked or even completely absent, the blood count either remains normal or shows only a slight increase of the mononuclears. Coagulation of the blood takes place in a different way in the two conditions. In spirochaetosis ictero-haemorrhagica the duration of the process does not exceed 10–20 minutes, and an irretractile clot may be formed. In acute yellow atrophy, on the other hand, coagulation is often considerably retarded. It often does not take place for 40 or 60 minutes and occurs in a normal manner. The pathological physiology of the two types of jaundice differs completely. In spirochaetosis ictero-haemorrhagica the activity of the liver, and especially of the bile- and urea-producing functions, is preserved for a long time and even increased. In acute yellow atrophy on the contrary the hepatic insufficiency is well marked, the jaundice remains slight, though the faeces have lost their colour, and the azotaemia is always moderate. These differences are explained by morbid anatomy. In spirochaetosis ictero-haemorrhagica the principal change is hyperplasia of the hepatic cell. It may be the only one observed and then the liver appears relatively healthy. More frequently, however, it is accompanied by actual lesions amounting to degeneration of the cells. In acute yellow atrophy the liver, as a whole, undergoes degeneration. It appears to be transformed into a uniform yellow mass, and on microscopical examination shows a general fatty infiltration associated with an embryonic type of sclerosis.

Toxic processes are well known to play the principal part in the aetiology of acute yellow atrophy. The disease may occur after drug intoxications of all kinds, and in the majority of cases proves fatal. Salvarsan and its substitutes have been incriminated, especially as slight involvement of the liver including jaundice is not uncommon after the use of salvarsan. The part, however, which salvarsan plays in the production of this damage to the liver is not always indisputably proved. It may be the principal toxic agent, or, on the other hand, only a subsidiary cause. Moreover, it is sometimes difficult to exclude syphilis which occasionally gave rise to acute yellow atrophy before the introduction of salvarsan. Stümpke records a case of acute yellow atrophy in the secondary stage of syphilis in which enlargement of the liver and jaundice were present before any specific treatment had been adopted. No improvement was caused by three intravenous injections of neo-salvarsan (0·3 gm.), and death took place about a month after the commencement of treatment.

Bernardi reports two cases of **secondary haemolytic jaundice.** The first case was that of a woman who developed splenomegaly and haemolytic anaemia four months after a pregnancy. The anaemia was fatal in two months. At autopsy the most notable findings were extreme fatty degeneration of heart, liver, and kidneys: marked erythroblastic reaction of the marrow and deposit of iron-containing pigment in the liver (both parenchyma and Kupfer's cells), and in the spleen and kidney. The spleen was greatly enlarged and showed much evidence of phagocytosis.

The case seemed, therefore, to partake partly of the nature of Biermer's pernicious anaemia and partly of that of haemolytic jaundice of the acquired type. The author discusses the points in favour of each, and decides on the diagnosis of haemolytic jaundice, the splenomegaly being especially in favour of this conclusion.

The case is thus one of a sort rarely if ever recorded previously. In support of the varying aetiology of haemolytic jaundice in the secondary and more acute form the author describes a case in which the same syndrome was associated with tuberculosis of the lungs which eventuated in miliary tuberculosis. The spleen showed lesions of both haemolytic jaundice and of the primary disease. Such cases have been recorded by other writers, but the histological details are of value.

In 1912 Bahrdt reported several cases in which inflammation of the gall-bladder and bile-ducts was completely masked by concurrent disease of the bronchi and lungs. Involvement of the lower lobes especially was a frequent occurrence, but the temperature became normal in a very short time (2–3 days), and the local signs rapidly subsided. After a number of such attacks a patient developed jaundice for the first time, and on the third day passed a single gall-stone. The lung disease then disappeared, and the patient remained free from symptoms till the age of 81, 13 years later, when he developed signs in the lungs again, and afterward showed evidence of gall-stones, the presence of which was confirmed at the autopsy. Apart from a full description by Kehr in his text-book, Bahrdt has been unable to find any mention of the association of pulmonary infection with cholecystitis. He thinks it most probable that infection of the lungs takes place via the duodenum, thoracic duct, inferior vena cava and right side of the heart. The fact that the pulmonary affection clears up more quickly than pneumonia due to other causes shows that the infection is not very virulent.

According to Landgraf the character of the war food in Germany is responsible for the great increase in round-worms in the human body. Several cases have recently been published of successful removal of ascarides from the bile-ducts or gall-bladder. In Horhämmer's case which occurred in a woman of 46, the symptoms were those of cholelithiasis without jaundice. At the operation an ascaris was removed from the common bile-duct, and calculi were found in the gall-bladder. Pribram successfully operated on two cases, in one of which a liver abscess was due to infective bacteria introduced by the worm from the intestine, and in the other round-worms were found in the common bile-duct, cystic and hepatic ducts. Landraf records a case in a woman aged 42, who had suffered for 3 years from frequent attacks of colic often associated with jaundice. At the operation two ascarids were found in the intrahepatic bile-ducts, and three in the gall-bladder together with some cholesterin stones. Mention may be made here of Sippel's case of occlusion of the common bile-duct by an echinococcus cyst. The patient, a soldier aged 39, fell ill in Russia in the spring of 1916. After three attacks in 18 months of what was regarded as gall-stone colic, an exploratory operation was performed. The gall-bladder and outer surface of the liver were normal, but the hepatic ducts and common bile-duct were thickened and dilated. On opening the common bile-duct a solitary unilocular echinococcus cyst was found. Recovery followed operation. There are only eight previous cases on record of operation for echinococcus cyst in the bile-passages.

**Diet in jaundice.** Chevallier advocates the early use of meat diet in jaundice. As soon as the patient can take solid food, red under-done meat should be ordered. Bread and pastry of all kinds are contra-indicated, but vegetables may be used to satisfy the patient's hunger. The most suitable meat is beef and horse-flesh the chemical composition of which is almost identical. Fatty meat such as mutton and especially pork are of less value. Veal, which is rich in nucleins and relatively poor in readily digestible albumins and haemoglobin, is inferior to beef. The writer attributes part of the therapeutical value of meat in jaundice to its soluble and insoluble albumin and especially myosin, which is rich in nitrogen and also in sulphur. Myosin is readily broken up by the gastric juice, and the syntonin and allied products formed in the stomach are transformed in the intestine into amino-acids which constitute the essential elements of nutrition. Fresh meat also contains certain mysterious principles which facilitate its digestion, 95 per cent. of meat taken raw or under-done being absorbed. Meat diet maintains and exaggerates one of the most important functions of the liver, viz., the production of urea. It also stimulates secretion of bile acids as well as the best cholagogues. Moreover it contains minerals, either associated with albumin such as phosphorus, or in a free state such as chlorides, phosphates, magnesium, chlorine and iron. Chevallier concludes by saying that though meat diet does not appreciably shorten the duration of the jaundice, it prevents asthenia and consequently shortens convalescence.

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## THE SURGICAL TREATMENT OF BRONCHIECTASIS AND PULMONARY ABSCESS

When a case of bronchiectasis which is not improving under medical treatment appears to have only a portion of one lung affected the question of obtaining relief by surgery arises. The cases which tend to be local in character are those originated by the inhalation of a foreign body, or of blood or other infected material, such as have been frequently reported of late as sequelae of tonsillectomy.

Cases of pneumonia and broncho-pneumonia subside, leaving an infected focus which may give rise to an abscess in one lobe, or to an interlobular empyema which then ruptures into a bronchus. Such patients suffer from continuous cough and expectoration of large amounts of foul muco-pus. They waste, and at any time may succumb to infection of the sound lung. But all, sooner or later, tend to have haemorrhages from the wall of the cavity which bring about death quickly, or after recurring a few times.

It is a necessary preliminary that tuberculous disease of the lung should be excluded. All surgical operations on a lung affected by tuberculous disease, not only fails to do good, but also is a direct cause of extension. The only treatment from which improvement has arisen is the creation of a pneumothorax, which is out of place in the cases of bronchiectasis and pulmonary abscess. In order to find out whether the disease is localized examinations by the bronchoscope and by X-rays are both valuable.

Yankauer by aid of the bronchoscope distinguished:

(1) Dilatation of one or both main bronchi. The walls of the bronchus are covered with glairy, tenacious, turbid muco-pus. After this has been sucked away, the pus does not reappear during the period of the examination up to half an hour.

(2) The main bronchus is not dilated; if it contains muco-pus and this is aspirated away, pus appears from the orifices of the smaller bronchi. It is of importance to note whether one or both sides are affected.

(3) If from only one side, it is to be observed whether the pus comes from one secondary bronchus and to identify that bronchus in correspondence with the X-ray photograph, and with the signs observed by auscultation and percussion.

These diagnostic measures may enable a conclusion to be reached that a particular part of one lung is the seat of an abscess, of multilocular suppuration, or of the communication of an interlobar loculated empyema with a bronchus. It is only when the diagnosis has been made that the bronchiectasis belongs to the third category that surgical treatment is indicated.

An X-ray examination including a stereoscopic view is of particular importance in localizing the seat of bronchiectasis or of an abscess affecting one lobe. In opening the pleural cavity however, unless there are adhesions between the lung and the parietal pleura, some collapse with displacement of the seat of the abscess may occur. There may then be a difficulty in reaching the abscess cavity with the exploratory needle, which will require to be directed rather more upwards. It will be of advantage if the operation can be done on an X-ray operating table, as when searching for foreign bodies.

The anaesthesia most often used by the various operators has been either nitrous-oxide gas with ether and oxygen as required, or intratracheal etherization, or local anaesthesia. Intratracheal etherization appears the most satisfactory granted its skilful administration, There has been reported no general objection to the administration of gas and ether through Clover's inhaler, by which the lung is kept expanded, always supposing the administration is as light as possible and the operation quickly done. There seems no necessity for the patient to have to undergo the operation under local anaesthesia, the insufficiency of which for all except very small operations is notorious.

The operative measures fall under the following heads:

(*a*) the mobilization of the ribs without opening the pleural cavity;
(*b*) the exposure of the lung and the search for the abscess cavity;
(*c*) the ligature of the artery supplying the affected lobe of the lung;
(*d*) the excision of the affected lobe.

### (*a*) Mobilization of the ribs

**Bronchiectasis involving all of one lung.** It is very doubtful whether any surgical treatment can afford relief when the bronchiectasis is found to involve more than one lobe of a lung. An artificial pneumothorax cannot be established, whether on account of pleural adhesion or more especially owing to the tough inflammatory tissue around the affected bronchi which prevents collapse. Moreover, collapse would favour the retention and absorption of the foul pus. The only measure which may possibly benefit the patient is the mobilization of the ribs of that side.

Morrison Davies reported the following case:

A deaf and dumb girl, drowsy and apathetic, presented signs of bronchiectasis involving all the lung on the right side, with some doubtful impairment of breathing at the left base. An attempt to introduce nitrogen into the pleural cavity on the right side failed, collapse of the lung being prevented by adhesions. At the first operation segments of the upper 9 ribs were removed subperiosteally through a posterior incision. At a second operation, 10 days later, the first seven costal cartilages were cut away subperiosteally. There was slight shock after each operation. The cough was relieved; the sputum diminished in quantity and was no longer offensive, the general condition was much improved; the girl became bright and was able to go to work all day.

### (*b*) The exposure of the lung and the search for an abscess cavity

*Mayne's case of abscess in the right upper lobe drained; death from haemorrhage.* A man aged 53 suffered in 1901 from right-sided lobar pneumonia after which bronchiectasis affecting the right upper lobe persisted. In 1915 an abscess in the right upper lobe communicating with a bronchus was diagnosed. Under nitrous oxide anaesthesia supplemented by a little ether the pleura was opened through the right sixth space and dense adhesions of the lung to the chest wall exposed. Thereupon by drawing forward the scapula, segments of the 4th, 5th, and 6th ribs were removed and the wound packed. Five days later an aspirating needle was passed into the abscess cavity followed by the cautery point, and a drainage tube inserted. The next day haemorrhage occurred from a large vessel which was noted to be pulsating on the inner wall of the abscess cavity. The haemorrhage recurred, and death followed 9 days after the exposure of the lung, and five days after opening the abscess cavity with the cautery.

F. T. Murphy of St. Louis described two cases, one very successful, one fatal from haemorrhage from the wall of the abscess, both done under local anaesthesia.

(1) A man aged 55 had become ill with pain in the right side nine months before. He had had since persistent cough, with expectoration of pus, and had lost 51 lb. in weight. Signs of an abscess cavity beneath the 8th right rib behind were noted, and 6 cm. of each of the 8th and 9th ribs were removed. There were no adhesions, but the patient inflated the lung which was sutured to the chest wall and the wound packed. Six days later the lung was explored with an aspirating needle, and after several punctures the abscess cavity was reached, a director inserted, and the track dilated. Foul pus escaped and a tube was inserted. After the discharge of much pus and portions of necrosed lung improvement set in; 18 months later the patient was in good health, the fistula had closed, and he had regained his former weight.

(2) A negro aged 37, following pneumonia 15 months before, had had a persistent cough and his sputa varied in quantity from 400–600 c.cm. daily. He had lost 32 lb. in weight. The X-ray photograph showed an irregular cavity on the right side extending from the 5th–9th ribs. After removing portions of the 5th and 6th ribs behind by drawing forward the scapula, adhesions were found and were cut away, together with the pulmonary pleura, so as to expose the lung substance. Then the wound was plugged. A few days later the abscess cavity was entered by means of an aspirating needle, the track dilated, and a drain inserted. The expectoration was reduced in quantity, so that four days later it amounted to 200 c.cm., but the man failed to improve; the urine contained some pus cells and casts. Ten days after the drainage he developed tonsillitis with diarrhoea. On the 11th day there was severe haemorrhage from the abscess cavity which recurred, and the patient died after the third haemorrhage on the 13th day.

Howard Lilienthal of New York reported in 1914 a series of 14 operations for pulmonary abscess and bronchiectasis which are worthy of a summary because they lead up to Lilienthal's advocacy of excision of a lobe whenever practicable.

*Case I.* Exploration in the right subscapular region for bronchiectasis. The abscess was not found. Death a few months later from haemorrhage.

*Case II.* Bronchiectasis of 18 months' duration in a male aged 19. Two inches excised from each of the 7th–10th ribs; the pleura was not opened. A month later sections removed from the 2nd–5th ribs in the axillary line, also without opening the pleura. There was some improvement, but haemorrhages recurred, the opposite lung became affected, and he died a month after the second operation.

*Case III.* Bronchiectasis of 9 months' duration in a man aged 30. Sections removed from the 3rd to the 5th ribs behind and the pleura opened. There were no adhesions and the lung was stitched to the chest wall. Subsequently repeated aspirations failed to reach a cavity. Some improvement followed, the wound healed, and the patient refused further treatment.

*Case IV.* Bronchiectasis of 6 months' duration in a man aged 23 with foul sputa complicated by haemorrhages. Portions of the 4th and 5th ribs behind were excised, the lung was adherent; the aspirating needle found pus, but only in small amount, the abscess being multilocular. A second search failed to expose the suppurating cavities more freely. The cough with sputa amounting to 3–5 oz. a day kept him miserable and he was unable to return to work. A year later pieces of the 4th–9th ribs were excised, and some improvement followed.

*Case V.* A woman aged 26 had had a year before a left-sided empyema following pneumonia; and a sinus persisted after the external drainage. Through the 6th and 7th ribs behind a honeycomb cavity was entered which communicated with five of the smaller bronchi. The parietal pleural wall was excised and the cavity packed. The patient recovered with an external bronchial fistula.

*Case VI.* A male aged 48 had diffuse pulmonary gangrene a fortnight after being attacked by septic pneumonia on the left side. After resection of the 8th rib much foul pus clot and gas escaped, gangrenous and sloughing lung was found, and the patient died 4 days later.

*Case VII.* A man of 42 had had for 7 months signs of a pulmonary abscess in the right upper lobe. The 3rd–5th ribs were excised in the axillary line, the lung was adherent, the abscess cavity was found, and the track of the needle dilated. Then the cavity was irrigated and partly plugged. This was a mistake for it infected the opposite lung and the patient died 4 days later.

*Case VIII.* A woman aged 24 had been spitting up pus for a month. The 8th and 9th ribs on the right side were resected, there was no fluid in the pleural cavity but some adhesions. No abscess cavity could be found and the wound was kept packed. A month later an abscess began to point in front under the right breast and this was found to open into a multilocular cavity. Whether this represented an excavation in the right pulmonary lobe or only a loculated empyema is uncertain.

*Case IX.* A man aged 22, following a paratyphoid pneumonia, developed signs of suppuration in the right lower lobe. After excision of the 7th and 8th ribs no fluid was found in the pleura and pus was withdrawn on aspirating the lower lobe. The wound was packed and 4 days later the track of the needle was cut through; much pus escaped, which contained streptococci. There was no improvement at first, partly owing to the multilocular suppuration in the lung and partly to a localized empyema forming. After instituting suction drainage the case finally healed and there was complete recovery.

*Case X.* A male aged 35, six weeks after an attack of appendicitis requiring operation, was attacked by cough; he expectorated much pus and there were some haemorrhages. As the case recovered without surgical treatment, it may have been one of interlobar empyema.

*Case XI.* A boy aged 12 had been ill for some months expectorating pus perhaps from an interlobar empyema. He was drained from the axillary region and recovered.

*Case XII.* A case of foetid bronchitis was at first taken to be a case of abscess in the right lower lobe. He was treated by Tuffier's proposal and the parietal pleura pushed inwards, but without benefit. Both lungs proved to be affected.

*Case XIII.* A boy aged 2¾ inhaled fragments of a nut which were removed through a bronchoscope after which a suppurative bronchiectasis persisted in the right lower lobe. The 9th rib was resected and the parietal pleura pushed in, the wound being plugged by some fat taken from the abdominal wall of another patient. As this failed a long incision was made over the 8th rib, the adhesions were separated, until a pedicle was made; then a ligature was applied, and the lower lobe beyond the ligature cut away. A slough of the lung including the ligature came away leaving a persistent sinus.

*Case XIV.* A man aged 33 had had an empyema following pneumonia on the left side which ruptured into a bronchus, and he had had cough and the expectoration of pus for 4 years. The cavity was drained through the 7th and 8th ribs and rapid improvement followed.

Elsworth Smith and Harvey Mudd were opposed to excision of a lobe on account of the risk of life, and they described the treatment of a multilocular abscess of the lung, having as its object the avoidance of that risk.

A woman aged 56 had suffered from bronchiectasis for three years and the right lower lobe was found to be affected. Three inches of the 8th rib was removed and a small abscess cavity in the lung opened. No improvement followed, so more of the 8th rib and some of the 9th were excised, and the sinus leading into the lung injected with bismuth solution, so that the dilatations might be recognized by the X-rays. Then tracts leading into bronchi were slit up by the cautery knife on several occasions under the influence only of morphia injections subcutaneously, a general anaesthetic being avoided. This was followed by improvement. Seven months later the wound had almost healed, there was no cough nor expectoration, and no haemorrhages had supervened.

Willy Meyer treated a similar case by laying open the bronchiectasis cavities with the cautery and improvement followed.

### (*c*) **The ligature of the branch of the pulmonary artery supplying the affected lobe of the lung**

As an alternative to excision of the affected lobe Morrison Davies described the following case:

A male aged 17 had had 7 years before a severe attack of bronchitis after which he continued to suffer from bronchiectasis. As this was found to involve the right base nitrogen was let into the pleural cavity in order to lessen the retention of muco-pus and diminish toxic absorption preliminary to the operation. Four days later ether was administered so as to keep the lung partially expanded. Portions of the 4th and 5th ribs were removed, and as soon as the chest was opened 2 per cent. novocain was injected into the vagus nerve above the hilum of the lung. Then the branch of the pulmonary artery to the right lower lobe was tied and the chest wound closed. On the 3rd day 24 oz. of clear fluid were aspirated from the pleura. At the next aspiration on the 5th day, the fluid was turbid and contained streptococci, so the pleura was drained through the incision. Three days later a counter opening had to be made behind through the 9th space under local anaesthesia. Two months later his sputa was reduced to ½ drm. per diem and only a small sinus persisted. Later still he was working as a hotel porter and had a fit of coughing only two or three times a week.

In 1917 Meyer reported three cases of improvement following such ligation. The objections to the procedure are that a free opening is required to reach the base of the lobe, and gangrene may follow the cutting off of the blood supply. Hence it is not clear that the operation is less severe than excision of the lobe.

### (*d*) **Excision of a lobe of the lung in one or more stages**

Excision has been especially advocated by Lilienthal in New York who has operated in a number of cases. In 1917 he gave the late results in three cases.

(1) A boy aged 6¼ had inhaled pieces of a nut at the age of 2½, some fragments of which were removed by the aid of a bronchoscope, but he developed bronchiectasis which involved the whole of the right lower lobe of the lung. This was shown both by X-ray examination and by the bronchoscope. The lobe was freed from adhesions, the pedicle ligatured, and the affected lobe removed in 1914. Three years later the boy was in good health, and except for the scar of the incision the chest wall was perfectly symmetrical and all the movements normal.

(2) In a boy aged 10 bronchiectasis had followed pneumonia and the right lower lobe was proved to be the seat of multiple abscesses. A long incision was made in the 7th intercostal space and the wound retracted without excising ribs. The hilum was crushed, then ligatured, the lobe cut away, and the stump fixed in the parietal wound to prevent retraction into the mediastinum. There was for a time a bronchial fistula, but finally complete healing with a symmetrical chest wall and normal movements.

(3) A woman after tonsillectomy developed a pulmonary abscess and bronchiectasis. She brought up as much as a quart daily of foul sputa. The X-rays showed a dense shadow in the position of the middle lobe of the right lung. In addition to the long incision in the 7th intercostal space, a piece of the 8th rib was excised and the 6th and 5th ribs cut through behind. Then a large piece of the middle and lower lobes enclosing an abscess cavity was removed. There was an immediate cessation of the cough and expectoration and recovery occurred. A year and a half after the operation there was still a bronchial fistula, the chest movements had been restored, and there was only a slight deformity.

Robinson reported five cases at Rochester, Minnesota.

*Case I.* A woman aged 36 had cough and expectoration for 2 years. In January 1909 the left lower lobe was exposed and a piece cut out for examination; it was reported to be affected by broncho-pneumonia. An empyema followed this which had to be drained by resecting a rib. The bronchiectasis continued with a free discharge from the empyema incision. In October 1909 a free opening was made, and the lower lobe separated from adhesions, including those connecting it with the upper lobe. The condition of the patient becoming bad, the operation was interrupted and the lobe packed around with gauze. A fortnight later the lower lobe was removed; there was considerable loss of blood before it could be controlled by ligature; the pleural cavity was packed around the stump. The large open cavity became partly lined with skin and there persisted a bronchial fistula at the bottom of the cavity. The patient died 4 years later of pneumonia.

*Case II.* A man aged 24 had suffered from bronchiectasis for 10 years dating from an abscess of the lung. The affection was found to be localized in the right lower lobe and it was removed by operating in stages. First the chest was freely opened and the adhesions separated. Two weeks later the lung was incised in six places. At the third operation, 3 months after the first, the right was more completely freed and packed around with gauze. Two months after the third, the lobe was excised at a fourth operation. In the following eight months the patient gained 30 lb. in weight; there was then no cough or expectoration. The wound was reduced by the chest falling in, the diaphragm ascending and the skin growing in, around two bronchial fistulae. A year later he was travelling in a show, and asked for the specimen of his lung in a bottle in order to increase his earnings.

*Case III.* A man aged 24 after tonsillectomy developed an abscess in the left lower lobe. A free opening was made seven months later, adhesions separated, and the lobe packed around with gauze. The patient got worse and died after a fortnight, when a large abscess was found to occupy the left lower lobe; an encapsuled empyema had formed owing to adhesions reforming, and there was also found suppurative pericarditis.

*Case IV.* A man aged 20 had inhaled 14 years before half a plumstone which he coughed up at the end of six months. He was found to have bronchiectasis affecting the left lower lobe. At the first operation a free opening was made, at the second, 14 days after the first, the adhesions were separated, and the lobe surrounded by gauze. Four months later part of the left lower lobe was excised. Seven months after the partial excision the man had improved, but there was a purulent discharge from the rest of the lobe.

*Case V.* A man aged 26 had a cough for 4 years and then underwent drainage of an empyema. Eight months after the drainage a free opening was made and the right lower lobe separated. Fourteen days later the adhesions had to be again separated to release an encapsuled empyema. At a fourth operation 3 clamps were applied to the base of the lobe and left on, no ligature being used. The lung in front of the clamps was cut away. Two of the clamps were removed on the 7th day and the third on the 9th. Two months after the excision the patient had much improved; there remained a large cavity with a bronchial fistula.

Lilienthal advocated excision, whenever a lower lobe was affected, at one operation; the objection to operating in stages was the tendency for the adhesions to reform and an encapsuled empyema to collect. Excision was necessary to get rid of the multilocular abscess cavities enclosed in dense fibrous, almost cartilaginous, tissue. The crushing of the pedicle tended to prevent the bronchus from being kept open by a cartilaginous ring. The stump after being touched with pure carbolic acid should be fixed in the posterior angle of the wound. It should not be covered over by a flap and allowed to draw back, for that promotes suppuration in the posterior mediastinum.

The exposure of the lung and the slitting up of sinuses should be reserved for cases where excision is impossible, as in the case of the upper lobes. But there is grave danger from haemorrhage, either as a direct result of the cutting into the lung, or on account of the continuation of the suppurating process.

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W. G. S.

# UNREDUCED OBTURATOR DISLOCATIONS OF THE HIP

### Gunshot injury causing an obturator dislocation and a compound comminuted fracture of the upper part of the shaft of the femur.

Pte. A. B., 1st Wilts, aged 22, was admitted to King George Hospital on December 23, 1918, having been repatriated from Germany in a miserable state. No information was available except the man's own account. He was wounded on March 23, 1918, he did not know how; but it is clear that he was struck on the outer side of the right femur just below the great trochanter in such a way as to drive the head of the femur downwards and inwards through a rent of the capsule in the neighbourhood of the cotyloid notch. At the same time a compound comminuted fracture of the upper part of the shaft occurred at the spot struck. After lying out for 3 days he was picked up by the Germans. For a month a splint was applied with the wounded leg parallel to the other, then for the next two months an extension of 20 lb. was applied in addition. An X-ray photograph was taken for the first time in August, after which his wound was explored and a splint and extension again applied. On October 4 wires were inserted into the seat of the fracture and suppuration continued to be free.

On admission the man was wasted, his skin and conjunctiva yellowish, his pulse small and 120 in rate, his temperature about normal. A sinus just below the great trochanter was discharging foul green pus. The region of the hip-joint was swollen and tender. The upper end of the femur stuck out horizontally and formed with the shaft of the femur a complete right angle. The limb was six inches shorter than the opposite one and presented several pressure sores. A probe inserted into the sinus passed up towards the hip-joint and encountered comminuted fragments of bone.

An X-ray photograph showed the head of the femur in the region of the obturator foramen with rotation outwards and abduction to a horizontal line of the neck and great trochanter. So far the photograph is precisely similar to an X-ray photograph of a fresh obturator dislocation, e.g. that published by Steinke. Immediately beneath the great trochanter, where the fracture had occurred, there was a collection of necrosed fragments, and amongst these an S-shaped loop of wire. During the week following admission the foul odour of the pus was reduced, but otherwise the man showed no improvement.

Amputation at the hip-joint was done on January 6, 1919. An incision was made along the line of the blood-vessels. First the superficial and then the deep femoral arteries and veins were separately tied; the external and internal circumflex, which were quite large, were tied close to their origin from the very commencement of the profunda artery. Behind this congeries of blood-vessels was a band as thick as the finger, formed by the anterior ileo-femoral ligament which was tightly stretched across the neck of the femur. After this was cut across the head was levered out from a suppurating cavity, of which the floor was formed by the obturator externus and the sides by very tough inflammatory tissue. The acetabulum was intact but filled up by dense suppurating fibrous tissue which was cut away. Both the cavity containing the head and the acetabulum were in free communication with the comminuted fracture below the great trochanter. After completing the amputation, the site of the fracture was examined; it involved the femur for two inches or more below the great trochanter, and the wire had been so inserted as to hold the shaft at a right angle with the upper end.

The patient rapidly improved under good food and nursing, and the wound had healed before he left the hospital. What may have been the opinion of surgeons in Germany must be a matter of conjecture.

In 1864 Weeden Cooke described a **dislocation of the head of the femur into the thyroid foramen with fracture of the upper part of the shaft. Reduction. Perfect recovery.** A boy aged 9 was walking along when his foot slipped into a hole and he fell with his legs separated. In trying to rise he fell on his right hip. Cooke suggested that the obturator dislocation occurred at the first slip and the fracture at the second fall. He was carried into the Royal Free Hospital collapsed and insensible. Within ten minutes of the accident the head of the bone was pushed upwards and outwards into the acetabulum with the characteristic noise. The ease with which this was done was attributed to the collapse and insensibility. The limb was then put up on an inclined plane, which was changed 3 weeks later to a long outside splint. The boy was discharged 5 weeks after the accident; 9 weeks after the accident he could walk without crutches, but with a slight limp. There was no shortening, but a good deal of thickening of the bone at the site of the fracture.

The ease with which Cooke's case was reduced resembled the case described by Curling and also by Ward. A man aged 38 was knocked down by a piece of timber falling across his back and right lower limb, by which he sustained an obturator dislocation and other severe injuries. He was collapsed and insensible, and as he was being put to bed the dislocation slipped back, presumably as the leg was adducted. Upon his death three days later from other injuries, there was found extravasation of blood into the gluteal and hamstring muscles, and along the sciatic nerve. On the inner side there was partial rupture of the adductor magnus and obturator externus. There was a large rent in the capsule extending from the ileo-pectineal eminence to the upper border of the obturator externus. Through this the head of the bone could be readily redislocated on to the outer border of the thyroid foramen, when the obturator externus muscle was pushed downwards and rendered tense. The ligamentum teres had been torn away from its attachment to the head of the femur; there was no extravasation of blood within the joint.

Rigby described the dissection of a similar case in which death followed soon after the reduction. The head of the bone had been forced further inwards and downwards to the perineum. There was a similar rent in the capsule, extensive extravasation from the vessels of the crucial anastomosis, the obturator externus and quadratus femoris partly torn, also the ligamentum teres had separated from its attachment to the head of the femur, whilst the cotyloid and transverse ligaments were found intact.

Annandale gave another like description in 1870. In all these the Y-shaped ileo-femoral ligament of Bigelow was intact.

It would appear from the accounts of many cases that obturator dislocations can be generally reduced without difficulty, even as long as three months after the accident. It is not, however, quite safe after this long interval from the injury. It happened to Allis when reducing a thyroid dislocation of 13 weeks standing that, without using great force, the junction of the superficial and deep femoral veins with the common femoral vein was ruptured, the patient collapsed and soon died. Blood had extravasated in the retroperitoneal tissue as high as the kidney as well as down the thigh.

Shaw described the pathological condition which ultimately results in the case of an unreduced dislocation. The head of the femur was placed in a cup-shaped cavity of bone which had formed in the thyroid foramen , the deepest part of the cup projected inwards for one inch into the pelvis, the remainder of the wall consisted of the borders of the thyroid foramen with irregular processes thrown out by the margin of the acetabulum, and by the rami of the ischium and pubes. One of the processes encircled the neck of the femur and locked it into place, evidently an ossification of the ileo-femoral ligament. The head of the femur had enlarged and part of its surface had a porcelain-like polish, otherwise it and the neck were normal in structure, The fibrous lip of the acetabulum had ossified, and from its upper margin a strong broad process of bone projected downwards towards the cavity. The deeper parts of the acetabulum were traversed by ridges of bone which intersected one another and partly filled it up. This shows that the capsule and ligaments of the acetabulum ultimately ossify—including the torn ligamentum teres.

### The treatment of the unreduced obturator dislocations by an open operation.

MacCormac operated about 21 months after the accident through a free posterior incision; the acetabulum had become quite shallow; the head, neck, and great trochanter were removed just above the lesser trochanter. The man recovered and could walk well with a high boot; the top of the femur was on the level of the anterior superior spine, with a shortening of

3 inches. There was no lordosis; by moving the pelvis the thigh could be bent on the trunk to 45°. The movements of the knee were perfect.

Johnson Smith, six months after the accident, excised the head of the bone by cutting down directly upon it through the adductor muscles. The patient recovered with a little shortening and fair movement of the hip, but the man remained crippled, for whether following the accident or the subsequent numerous attempts at reduction the muscles supplied by the external popliteal nerve had been paralysed.

G. R. Turner also excised the head of the bone through an adductor incision in a case of 3 months' standing. He had in addition to divide some fascial contractures. Recovery occurred with a fixed hip and two inches of shortening. The man could walk all day without trouble.

Endlich tried to preserve the head and replace it in the acetabulum. In a boy aged 9 a posterior incision was made and the acetabulum which was filled by fibrous tissue was cleared out. The head could be rotated back into the acetabulum, but tended to slip out again owing to flattening of the rim. Suppuration and partial necrosis of the head followed; the hip became ankylosed in adduction of 15°, flexion to 80°, and rotation inward 10°.

In the case of a woman aged 37, Endlich made an incision through the adductors and tried to press the head of the bone towards the acetabulum. Failing in this a posterior incision was made and the acetabulum cleared of fibrous tissue. It was still impossible to return the head until the lower rim of the acetabulum had been cut away. The man recovered and the hip could be flexed from full extension through 35°, it could be abducted and adducted through 5–7° and could be rotated through 5°. There was some osteoarthritis.

Dollinger recorded two cases. A man of 48 had had a dislocation for five months. Through a posterior incision the acetabulum was cleared out, the attachments of the obturator internus, the gemelli and pyriformis divided, and the head of the bone rotated. The head slipped round to the dorsum ilii and was then reduced into the acetabulum. Suppuration and ankylosis followed. After healing the patient walked lame and with pain.

In the second case a man aged 22 had had the dislocation for 11 weeks. The acetabulum was cleared out, and again on rotating the head it slipped round to the dorsum ilii and was then reduced. Suppuration was followed by necrosis; the head was excised and recovery followed with 6 cm. of shortening,

Szenes described the case of a private crushed under the wall of a mud hut which had been blown in. Three days later an attempt was made to reduce the dislocation under an anaesthetic. Two more attempts at reduction were made, also in vain. Six and a half months after the injury the acetabulum was explored through a posterior incision, and then the head rotated when a sciatic dislocation was produced; from this position the head was levered into the joint. A splint and extension were applied and the wound healed by first intention. Three months later he was exhibited at a meeting of the Vienna Medical Society, walking with a fixed hip and a slight limp, owing to 5° of adduction.

### Dislocation on to the dorsum ilii with fracture of the upper part of the femur.

The following case was under an old-fashioned surgeon some thirty years ago. A boy was riding on a cart when it overturned; as it did so he jumped out. He was treated for fracture of the upper third of the femur and it was not until ten weeks later that a dislocation on the dorsum ilii was discovered. The surgeon then excised the head, neck, and great trochanter, and afterwards pushed the upper end of the femur into the acetabulum which had already become filled up to a considerable extent.

A similar case was recently described by Malcolm L. Harris. A boy fell on a snow bank and a fracture of the upper third of the femur being diagnosed, the fracture was fixed by plates and screws on the same day as the accident. The next day a dislocation on the dorsum ilii was discovered by X-ray examination. An incision was made, the head levered back into the acetabulum, and the plates removed. A few days later, as the position of the fractured ends were unsatisfactory, the plates were reapplied. Five months later there was good union with a movable hip.

### Conclusions.

(1) An obturator dislocation, before the muscles become rigid, soon after the accident, can be easily reduced.

(2) In the rare case of a dislocation complicated by fracture of the upper third of the femur, direct pressure on the head of the femur may suffice to effect reduction.

(3) The ileo-femoral ligament crossing the neck of the bone, when the head is lying on the obturator foramen, tends to fix the head of the femur like a button in a button-hole. To this is added first rigidity of muscle, then fibrosis, then ossification as an obstacle to reduction by manipulation.

(4) Manipulation, when much force is used, tends to add to the rupture of the deep rotator muscles and of the blood-vessels. When an open operation is resorted to after forced manipulations have failed, then suppuration may follow.

(5) When gentle manipulation fails, an open operation should at once be undertaken. The head may then be pushed or levered into the acetabulum. Even if complicated by a fracture, the fracture may be satisfactorily fixed and permanent lameness thus avoided.

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W. G. S.

# ABSTRACTS

## SURGERY

**Bull, P.** Om cancer recti, særlig om dens behandling. [**Cancer of the rectum, with special reference to its treatment.**] *Norsk Mag. f. Lægevidensk.*, 1919, **80**, 1233–1310.

Professor Bull's paper, which includes a historical review of this subject, is largely devoted to the experiences gained in the Surgical Department B of the Rikshospital in Christiania. In addition to 36 hospital cases, 8 cases operated on in private practice are analysed, the total of 44 cases occurring in the period 1897–1918. In this period 71 cases of cancer of the rectum were observed, and of these, 44 or 62 per cent. underwent a radical operation. The operation mortality was 11·4 per cent. (5 deaths). Of the 39 who survived the operation, 17 were still alive, the average post-operative duration of life being 8½ years. 12 patients survived the operation more than 3 years, and if the five operation fatalities be excluded, permanent cure could be claimed in 12 out of 39 cases, or 30·8 per cent. This ratio could be raised to 38·4 per cent. if the 3 patients who lived more than 3 years after the operation, but ultimately died of cancer, be included among the 'cures'. The 5 deaths occurring in connexion with the operations were due to heart failure on the fourth day (chloroform poisoning) in 1 case, sepsis in 3 cases (one of which was combined with uraemia, and another with pulmonary embolism) and pulmonary embolism in 1 case.

Discussing the results of the various operations, Bull notes that the mortality was highest among the cases of resection, as 4 deaths had to be recorded in 14 cases. The dangers of resection appeared to be greatest when undertaken by the dorso-sacral route (Kraske). There were no deaths among the 6 cases of recto-sigmoid resection. Of the 10 patients who survived resection, 5 acquired full continence, and 5 still suffered the discomforts of an artificial anus. A comparison of the ultimate results with the extent and localization of the disease brought out the surprising result that the prognosis appeared to be little affected by the pre-operative distribution of the disease—a finding which Bull interprets as indicating operative treatment even in extensive disease. His results were also practically the same whether he operated close to, or far from, the diseased area. He admits, however, that his figures are not large enough to establish beyond doubt the truth of his unorthodox conclusions. His own material throws little light on the microscopic structure of the cancer in relation to prognosis, but he quotes Petersen, Colmer, and Zinner to show how contradictory are the findings of microscopists when they attempt to correlate their observations with the results of clinical experience.

The following indications and contra-indications are given. Localization of the disease at a high level is no longer a contra-indication, nor are adhesions to the vagina, the uterus and its appendages, provided they are not too extensive. The prognosis is worse when adhesions have formed in connexion with the urethra, prostate, bladder, and sacrum, though it must be borne in mind that the adhesions may be of inflammatory, not of malignant origin. Involvement of the inguinal glands usually excludes the possibility of a radical cure, but this is not necessarily the case with the ano-rectal and intra-pelvic glands which can often be removed with the tumour. Enlargement of the retroperitoneal glands is a contra-indication to operation ; unfortunately, they are difficult to detect without an exploratory laparotomy. This objection also applies to secondary deposits in the liver. Indeed, even an exploratory laparotomy may fail to reveal this contra-indication. All the same, Bull emphatically advocates the adoption of the exploratory laparotomy, a hitherto undeservedly neglected method for deciding for or against an operation. Diabetes is a serious complication as it favours post-operative infection, and adiposity and arteriosclerosis are also of ill-omen. But great age, though it is undoubtedly an unfavourable factor, is not an absolute contra-indication ; one of Bull's patients was 75 at the time of operation, and was still well 4½ years later. His discussion of the various operations to choose may be summed up in one word : individualization. He attaches much importance to the two following technical points. To avoid partial or total gangrene of the section of gut pulled down at the operation, the art. haemorrh. sup. should be ligatured above the origin of the art. sigmoid. ima. The risk of fatal collapse and of pulmonary complications can be reduced by a more general use of local anaesthesia, notably sacral or para-sacral anaesthesia. C.L.

**Bull, P.** Videre erfaringer om behandlingen av lungetuberkulose med extrapleural thoracoplastic. [**Thoracoplasty in the treatment of pulmonary tuberculosis.**] *Norsk. Mag. f. Lægevidensk.*, 1919, **80**, 1105–30.

During the past three years, Professor Bull has performed thoracoplasty in 26 cases of pulmonary tuberculosis, bringing his total up to 37 cases. The operation was performed on the left side in 24 cases, on the right in 13. In his first series there were three operation fatalities, in his second series only one. The operation mortality was thus reduced from about 30 per cent. to 4 per cent. He attributes this great advance to performing the operation in two stages instead of one, and to various improvements of technique.

When the operation was completed in one stage, collapse was comparatively common. When there was an interval of three to four weeks between the two stages, collapse was observed only on two occasions. At the first stage only local anaesthesia was induced, and the ribs, from the 11th to the 5th, were resected. At the second stage general anaesthesia, with ether and chloroform in the proportion of 3 to 1 was often induced, as local anaesthesia was more difficult to induce at this stage, and the patient was apt to dread a repetition of the operation under local anaesthesia only. But when there was a large cavity in the apex of the lung, general anaesthesia was avoided as far as possible for fear of pus being tilted out of the cavity into the bronchi, whence it would be imperfectly expectorated if the patient were unconscious. The total length of resected rib was often about one metre, but the best results were achieved by the resection of 120–130 cm. or more, especially when cavities required collapsing. In the first series, the first rib was resected only in one case; in the second series it was resected in 15 cases, and Bull includes it among the ribs to be resected as a matter of routine unless there is diffuse infiltration of the lung, with only a few foci of disease in the apex. Since 1916 he has adopted Key's method of drainage; the muscles are sutured in one layer with cat-gut, the skin with silk, an 8 to 10 cm. glass drainage-tube being placed in the postero-inferior angle of the field of operation, and removed on the second or third day, This procedure was a definite advance on the plugging with tampons practised earlier. Since January 1917 Bull has adopted, in nine cases, Tuffier's device of fat transplantation with a view to collapsing rigid cavities. On account of the discomfort induced by coughing when the fat was taken from the abdominal wall, the graft was taken in some cases from the thigh. But as the fat from this source was too stiff to adapt itself to the irregular cavity in the chest wall, the fat graft had again to be taken from the abdominal wall. In five of the nine cases the fat achieved its object, becoming a fibrolipoma around which the tissues healed uneventfully. The four failures were traced to causes that, with improved technique, could in the future be eliminated.

Reviewing his results, Bull found that of the 33 patients who survived the operation, seven had died of tuberculosis, one of these deaths occurring almost four years after the operation. Another patient died of influenzal pneumonia. 25 were still alive, and of these 11 were cured, i.e. they were fit for work, were always afebrile, and tubercle bacilli were no longer demonstrable in the sputum. There was also no cough except when they caught 'colds'. Seven survivors still exhibited signs of pulmonary tuberculosis, and in seven other cases less than a year had passed since the operation had been undertaken, and no definite verdict could yet be given. But in several of these cases tubercle bacilli had disappeared from the sputum, and there was every prospect of a permanent cure. The crux of the matter is the condition of the opposite lung; a flare up of the disease in this lung is responsible for a large proportion of failures. Bull is very favourably impressed by the results which can be achieved by this operation in otherwise forlorn cases, and he deplores the ignorant prejudice against it shown by many physicians incapable of thinking surgically. C. L.

**Pignatti, A.** Sulla legatura sperimentale dell' uretere associata a nefrotomia. [**Experimental ligature of the ureter, with nephrotomy.**] *Policlin.* (*Sez. Chir.*), 1919, **26**, 231.

The effects of simple ligature of the ureter have already been studied by previous observers. The object of the present series of experiments was to ascertain whether nephrotomy performed simultaneously with ligature of the ureter produced any modification in these effects, and what effects followed simultaneous decapsulation and ligature. Rabbits were used in the experiments and the nephrotomy was made deeply into the convex border of the kidney so as to open the renal pelvis, the wound being subsequently closed by means of interrupted silk sutures. The experiments performed were: (1) Ligature of ureter and decapsulation. (2) Ligature of ureter and nephrotomy. (3) Ligature of ureter, nephrotomy, and decapsulation. The animals were killed after periods varying from ten days to one year.

From these experiments it would appear, first, that ligature of the ureter associated with nephrotomy results in the production of a hydronephrosis, but that this is of slower development than after simple ligature; secondly, that when decapsulation is performed with ligature and nephrotomy no hydronephrosis arises (at least within the period of the experiment, namely one year); the kidney retains its normal size or is somewhat diminished, and a cystic sac is not produced; the renal substance is of good width, and histologically the cortex is in some places almost normal in appearance, more especially in the vicinity of the nephrotomy wound: elsewhere there is disappearance of the tubules, and the medulla consists of a highly vascular connective tissue containing tubular remnants.

Pignatti considers that the notable influence of decapsulation on the results of ligature with nephrotomy is to be attributed to the development of extra-renal vessels. In the experiments with decapsulation he noted the formation of extensive adhesions between the kidney and the adjacent muscles. These were accompanied with an abundant vascular development on the external surface of the kidney, more particularly along the nephrotomy scar, and of the glomerular circulation in the surrounding cortex. It is conceivable that this new vascular tissue may be effective not only in maintaining the nutrition of the renal substance but also in the absorption of the fluid accumulated in the renal pelvis. T. W. P. L.

**Fantozzi, G.** Peliosi reumatoide simulante l'appendicite. [**Peliosis rheumatica simulating appendicitis.**] *Policlin.* (*Sez. Chir.*), 1919, **26**, 281.

The patient, a boy of 11 years, had been seized with acute abdominal pain a few hours before. The pain was localized in the right lower quadrant of the abdomen and was associated with fever, vomiting, anxious expression of the face, and small, frequent pulse. There was marked tenderness limited to the right iliac fossa, with muscular rigidity and hyperaesthesia. While preparations were being made for operating on the appendix several small petechiae were noticed in the region of the elbow. Further examination revealed scattered spots of similar character at the lower part of the back. Operation was deferred in view of the possibility of the case being one of purpura haemorrhagica, and further inquiry made into the history of the case. It then appeared that the patient had had an eruption of red spots on the lower limbs one month previously. The spots disappeared in the course of a week, and were followed by painful swelling of the ankle, first of the right limb, then of the left; on the succeeding days similar swelling of the knees, shoulders, and elbows occurred.

In the subsequent course of the disease, the petechiae increased in number, and were distributed over the back, abdomen, and thorax; painful swelling of the wrists and back of the neck occurred; and the skin over the right iliac fossa became swollen, painful, and discoloured by a large ecchymosis. These symptoms rapidly disappeared, and recovery was complete within three weeks from the onset of the abdominal attack.

Fantozzi, in commenting on this and previously recorded cases, refers to the fact that a petechial eruption may be absent, or in some instances nothing more than slight swelling of one or more of the joints may be present to guide one to a correct diagnosis In fatal cases post-mortem examination has disclosed haemorrhages in the internal organs—liver, spleen, bladder, intestines, and other viscera—and it is to these attacks of visceral haemorrhage that Fantozzi attributes the abdominal crises. In his case there appears to have been a peritoneal haemorrhage in addition, localized at first in the serous membrane, but subsequently involving the whole thickness of the abdominal wall, as evidenced by the ecchymosis which made its appearance in the right lower quadrant. T. W. P. L.

**Forni, G.** Sul decorso della tuberculosi in un rene dopo l'asportazione del rene opposto. [**Effect of nephrectomy on tubercle of the opposite kidney.**] *Arch. Ital. di chir.*, 1919, **1**, 85.

Nephrectomy in cases of bilateral tubercle of the kidneys is sometimes followed by an arrest of the disease in the remaining kidney, provided the disease in this is not advanced. The series of cases reported by Moulinas (*La Presse médicale,* No. 70, 1916) may be taken to illustrate this fact. He classifies his cases under three headings: (1) One kidney gravely affected, the other slightly. In eighteen nephrectomies there were seven deaths between 6–30 months after the operation: the remaining cases were cured. (2) Both kidneys equally, but not severely, affected. In these cases medical treatment only was adopted. (3) Both kidneys severely affected. Three cases in which nephrectomy was performed died rapidly with anuria.

Forni has performed a number of experiments in order to ascertain whether any modification of the tuberculous process can be detected as the result of removal of the opposite kidney. The animals used were guinea-pigs and rabbits: the method of procedure was to inject a small quantity of a culture of the bacillus into the kidney of one side, to remove the opposite kidney after an interval of 15–60 days and kill the animal after a further interval of 30-90 days, during which the remaining kidney would be undergoing hypertrophy—the cause, as is supposed, of the amelioration of the condition. The histological changes found in the diseased kidney were then compared with those in control animals, in which the kidney of one side had been injected with tubercle without a subsequent opposite nephrectomy.

1. **Animals nephrectomized 15 days after inoculation and killed after 30 days.** In the guinea-pigs the tuberculous process was less generalized through the kidney than in the controls; and although no evidence of actual retrogression could be detected the process was more limited and circumscribed. There was also a marked reaction in the form of multiplication of the epithelium and small cell infiltration with tendency to fibrous transformation. This was much less marked in the controls. In the rabbits, degenerative changes and deposits of typical tubercles were found, while in the controls there were definite caseous masses with softening and cavity formation.

2. **Animals nephrectomized 30 days after inoculation and killed after 60 days.** In the guinea-pigs, the alterations consisted in infiltration with lymphocytes and epithelioid cells without destructive changes or the formation of definite tubercles. These alterations were much less generalized in the nephrectomized animals, in which also a development of fibrous tissue was present in places. In the rabbits, definite tuberculous lesions could not be distinguished, but merely reactive changes in the form of proliferation of the renal epithelium and lymphocytic infiltration of the interstitial tissue, changes which were notably more intense in the nephrectomized than in the control animals.

3. **Animals nephrectomized 60 days after inoculation and killed after 90 days.** In the guinea-pigs, the tuberculous granulations showed commencing sclerosis and fibrous tissue formation. In the controls, besides a diffuse infiltration of the tuberculous areas, there were degenerative changes and foci of caseation. In the rabbits, there was caseation with cavity formation, but in all cases this was associated with an abundant production of fibrous tissue in and around the tuberculous foci. In the controls the destruction of renal substance was much greater, resulting in the formation of large cavities; and in the surrounding tissue there was an absence of reactive phenomena and of fibrous tissue formation.

From these experiments Forni concludes that a slowing and limitation of the extension of the tuberculous process occurs as the result of the nephrectomy. T. W. P. L.

**Francini, M.** Le ferite delle grandi articolazioni. [**Wounds of the large joints.**] *La chirurgia degli organi di movimento*, 1919, **3**, 341.

Francini contributes an exposition of the principles underlying the treatment of wounds of the larger joints, deduced from experience gained during the war. Expectant treatment is justifiable only in cases of perforating wound with punctiform apertures of entry and exit, causing injury confined to the synovial membrane or producing a simple channel through the epiphysis without comminution. Such wounds, provided they are not caused by projectiles which render infection probable, such as grenade fragments, may be treated with absolute rest and immobilization, whatever the joint involved. They frequently run an aseptic course, but expectant treatment should be abandoned at once if signs of inflammation arise. The treatment to be adopted in more serious injuries will vary with the extent of the injury, the probability of infection or its actual presence, and the particular joint involved.

With regard to the extent of the injury, when comminution of the epiphysis is present, the joint should be opened, sequestra removed, the surfaces regularized and partial, atypical resections carried out, followed by complete suture or partial closure round a drainage-tube according to the severity of the injury. Wounds received within the explosive zone, causing extensive destruction of the joint, comminution of the epiphysis, avulsion of the surrounding skin, tendons and capsule, and possibly grave injuries to vessels and nerves, may render immediate amputation necessary. This, however, should be resorted to only when it is manifest that the functional value of the limb is lost or the general condition renders it necessary: for even in unpromising cases ample open treatment with wide resections will often save a limb, and, in a young subject with good powers of recuperation, give surprisingly favourable functional results.

With regard to the probability of infection, this is increased by the presence of a haemarthrosis of any considerable size; and in cases which would otherwise be suitable for expectant treatment the blood should be evacuated aseptically by acupuncture, whether the haemarthrosis is due to direct injury or is the result of a fissure extending from a juxta-epiphyseal fracture. The probability of infection is also greatly increased when the projectile is retained within the joint or in the epiphysis. Of special importance in this respect are fragments of shrapnel, which produce large apertures of entry and abundant haemarthrosis, and carry fragments of clothing and other sources of infection into the wound. Small grenade fragments have a similar significance, and even when they fail to lodge produce infection in the majority of cases. In this class of injury early surgical intervention is needed, with careful excision of the track, ample incision of the synovial membrane, evacuation of the haemarthrosis, extraction of foreign bodies, and cleansing and disinfection of the joint-cavity, followed by complete suture, or partial suture round a drainage-tube, according to the severity of the injury, or after the use of powerful antiseptics.

When infection is manifestly present, as indicated by fever, the general condition of the patient, pain and tension in the joint, congestion of the skin, the red streaks of lymphangitis or swelling of the glands, immediate surgical treatment is required. In cases of wound of the synovial membrane only, with merely slight osseous lesions, arthrotomy with open treatment may suffice. A single linear incision or multiple incisions in situations least likely to damage the structures of the joint, followed by efficient drainage, can be adopted in the first instance. If the process is not controlled by these measures, the joint should be widely opened by turning back a flap, permitting thorough exploration, resection of the synovial membrane and the application of disinfectants or caustics.

When suppuration is associated with severer lesions of the bones, limited incisions should not be employed, but the joint opened up widely and treated on the lines just mentioned, with the addition of removal of fragments and typical or atypical resections, as the severity of the injury and the particular joint involved may require. Some cases of grave suppuration of the synovial membrane without serious lesions of the articular extremities may be advantageously treated by ample opening up of the joint and luxation of the ends of the bones outside the joint-cavity. Complete control is obtained by this means, but the function of the joint is generally lost and exfoliation of the cartilaginous surfaces may render resection ultimately necessary. Only in exceptional conditions, such as the gravest forms of sepsis and the progressive forms of gas gangrene, is removal of the limb justifiable. In all other cases, including those cases of gas gangrene which are less markedly progressive, conservative treatment should invariably be adopted in the first instance.

Modifications in treatment depending on the particular joint affected, have reference to the route of access to the joint-cavity, the securing of efficient drainage, and the result aimed at with regard to the function of the joint, whether mobility as in the case of the elbow, or stability and length of limb, as in the knee-joint. The most convenient route of access to the shoulder-joint is through an antero-external incision in the delto-bicipital groove; this avoids the danger of injury to the circumflex nerve. In comminuted fracture of the head of the humerus, in order to regularize the focus of infection and secure satisfactory drainage it is advisable to resect the head of the bone and close the capsule round a suitably placed drainage-tube. This is preferable to simple arthrotomy with removal of sequestra. The same course may be adopted with advantage in injury of the hip-joint and ankle, the head of the femur or astragalus, when this is much involved, being excised in order to provide free drainage and obviate prolonged suppuration. In opening the ankle-joint in comminuted fractures Francini gives the preference to antero-lateral linear incisions.

When any doubt exists as to the ultimate effect of the injury on the function of a joint it is important to direct the treatment towards securing mobility or stability according as the one or the other is the more important for the utility of the limb. In case of the elbow-joint an attempt should be made to retain mobility at whatever cost. Mere removal of sequestra and regularization of the surfaces should not be adopted, but early total resection, or in some cases hemi-resection (humeral) performed. A simple technique gives the best results: a posterior linear incision, preservation of the periosteum with the muscular insertions and ample resection of the bones. This line of treatment, in which the anatomical structure of the elbow-joint is sacrificed for the preservation of function, should be adopted in all cases except the simplest perforated wounds with punctiform apertures of entry and exit and absence of fractures. In wounds of the knee-joint with retention of the projectile it is best to follow the track when this deviates but little from the parapatellar incision; and the latter is suitable for removing a foreign body from the joint-cavity. If the operation is performed early the wound may be closed completely; otherwise it should be only partially closed or left open. A similar or more lateral incision is used for removing a fragment from the condyle. If the knee-joint is already suppurating, but grave lesions of the bones are absent, bilateral parapatellar arthrotomy should be performed, with postero-lateral counter openings; and the projectile should be extracted if possible. This treatment should be employed before resorting to an anterior flap, which, owing to division of the patellar ligament, is a serious disadvantage if any hope of retaining the mobility of the knee-joint exists. In severer injuries it is desirable to aim at stability and length of limb, rather than mobility, and an economical treatment rather than systematic resection should be adopted:—removal of sequestra, regularization of the surfaces, full opening up of the joint-cavity, partial and atypical resections and good drainage if there is a probability of infection or the joint is actually inflamed. In still more extensive injuries, with destruction of the normal relations between the bone-ends, systematic resection becomes necessary, followed by partially or completely open treatment. If suppuration is already present in such cases, the joint should at once be opened fully by anterior flap, and typical femoral or femoro-tibial resection carried out in order to control the septic focus and drain thoroughly. In fractures of the patella, if there is any doubt as to the presence of infection, the bone should be sutured and a lateral arthrotomy incision made to provide for drainage. Fragments not absolutely necessary for the reconstitution of the patella should be removed, and if much comminution has occurred it is probably best to perform a subperiosteal resection.

Only exceptionally are injuries of such gravity as to render amputation necessary in wounds of the knee-joint. The operation is indicated mainly in cases of sepsis arising where conservative treatment had been adopted. In 101 cases Francini performed secondary amputation in two cases, and only after repeated efforts at conservative treatment: in no case was primary amputation resorted to. In the remainder of the cases severe septic processes were controlled by linear arthrotomy or flap (16 cases); or by arthrotomy with removal of sequestra, or mono- or bi-epiphyseal resection (6 cases). There were 9 deaths.

In injuries of the hip-joint the danger of ankylosis is relatively slight, no special measures, therefore, are needed to preserve mobility, and economical treatment should generally be adopted. Many cases of perforated wounds of the wrist run an aseptic course and heal under expectant treatment without serious loss of function. In severer cases resection of the radial and ulnar extremities and the row of carpal bones becomes necessary, and if the hand is severely injured at the same time a mutilating operation cannot be avoided, which, however, should be as conservative as possible.

T. W. P. L.

**Camera, U.** Sopra un caso di resezione osteoplastica bilaterale alla Wladimiroff-Mikulicz. [**Bilateral Mikulicz-resection.**] *La chirurgia degli organi di movimento*, 1919, **3**, 401.

**Serra, A.** Protesi per amputazione osteoplastica bilaterale alla Wladimiroff-Mikulicz. [**Prothesis for bilateral Mikulicz-resection.**] *La chirurgia degli organi di movimento*, 1919, **3**, 406.

The interest of this case lies in the fact that the operation was performed on both feet, in conditions in which a double amputation was the only alternative; and that the practicability and value of the double operation is fully established by the satisfactory results obtained. The patient, while lying in a prone position, was struck by a grenade fragment, which carried away both heels and the posterior half of the soles, the wounds extending laterally into the malleolar regions. On the right side the whole of the os calcis, almost the whole of the astragalus and the tip of the external malleolus had been carried away; on the left side, the whole of the os calcis and part of the astragalus. Sequestra were removed, the wound cleansed and disinfected, and, within a month, the surfaces were covered with healthy granulations. The osteoplastic operation was then performed, first on the right foot, and, after a week's interval, on the left. The remnant of the astragalus was removed, and the malleoli, the articular surfaces of the cuboid and scaphoid bones resected. The bony surfaces were then brought together and secured in position by means of iron wire inserted on either side. The edges of the skin were drawn together as far as possible and the wound allowed to granulate up. The bones united firmly, and healing was complete in about eight weeks. Dorsi-flexion of the toes was then performed under an anaesthetic and at a single sitting, a simple apparatus being subsequently applied in order to maintain the new position. Two years later the patient reported that he was able to walk several miles without fatigue, that he could dance and ride a bicycle, and that he suffered no pain.

The apparatus provided by Serra for this case consisted of leather leggings laced up the outer sides and reaching as high as the tibial surface of the knee-joint. Inferiorly the leggings were rounded and closed, except anteriorly in order to allow the toes to protrude, and an artificial foot was attached by means of a hinge-joint. In this apparatus the weight of the body is supported at the metatarso-phalangeal joints, not distributed over the surface of the leg; and it is a point of practical importance that the transverse axis of the foot-hinge should be placed somewhat in advance of the axis of the leg.

T. W. P. L.

## NEUROLOGY

**Fildes, P., Parnell, R. J. G.,** and **Maitland, H. B. The occurrence of unsuspected involvement of the central nervous system in unselected cases of syphilis.** *Brain*, 1918, **41**, 255.

**Fildes, P.** and **Parnell, R. J. G. An investigation into the ultimate results of the treatment of syphilis with arsenical compounds.** *Medical Research Committee, Special Reports Series*, 1919, **41.**

The importance of lumbar puncture as a guide to the state of the nervous system in early syphilis, and the frequency of a meningeal reaction at this stage of the disease, have been known since the observations of Ravaut in 1903. In a recent paper (vide *Medical Science*, 1919, **3**, 336), Plaut lays it down that in the treatment of syphilis, and especially syphilis of the nervous system, the condition of the cerebrospinal fluid is the standard by which we must estimate the efficacy of treatment, and for this purpose repeated lumbar punctures are needed as a control.

In this connexion, the extensive investigations carried out at Haslar by Fildes, Parnell, and Maitland are of the greatest importance. .

(1) In *Brain* they record the results of examination of 624 early unselected cases of syphilis. MacIntosh and Fildes have already shown that the nervous lesions of 'parasyphilis' do not differ essentially from those found in tertiary syphilis, and in the present investigation the classification of syphilis into primary, secondary, and tertiary stages has been abandoned as conveying no essential meaning. The following division based upon a time and clinical factor has been adopted :

*Division I.* Cases in which the spirochaete is found in an inoculation lesion before the Wassermann reaction (= W. R.) has become positive.

*Division II.* Cases with or without an inoculation lesion, and with no other signs than a positive W. R. in the serum and general glandular enlargement.

*Division III.* Cases with signs or history of general infection, with positive W. R. in serum, and within eleven weeks of infection.

*Division IV.* Similar cases from twelve to twenty-six weeks after infection.

*Division V.* Similar cases from twenty-six weeks onwards.

*Division VI.* Cases over twenty-six weeks with no other signs than a positive W. R. in the serum.

It will be seen that Divisions I and II include early and later cases of 'primary syphilis, Divisions III and IV early and later 'secondary' cases, and Division V includes still later 'secondary' cases, while Division VI comprises 'latent' cases.

In this investigation the examination of the nervous system include a clinical examination of the patient and the investigation of the cerebrospinal fluid. In their examination of the latter they employed the W. R. and a cell count. They do not regard albumin and globulin tests as being a very valuable addition to these two reactions.

**The cerebrospinal fluid.** Their method is as follows: 4 volumes of fluid are diluted by one of polychrome methylene blue (1 in 3 in water) and counted in a Thoma-Zeiss chamber. They regard 4 cells to the c.mm. as within physiological limits, from 5 to 9 as 'doubtful', and from 10 upwards as definitely abnormal and indicating involvement of the central nervous system.

In the series of 624 cases, they found a definite pleocytosis in 115 (18 per cent.), and a 'doubtful' increase in 73 (11 per cent.). Therefore in about 30 per cent. of the total number there is evidence of a meningeal reaction. The pleocytosis was most frequent in Division IV (i. e. late secondary cases), 29 per cent. of the cases in which showed this condition.

Of the total number, a positive W. R. in the fluid was found in 41, that is, in 6 per cent. The higher the cell count the more frequent the positive W. R., and this was constant in fluids with a cell count of over 200 per c.mm.

They found that a recent course of arsenical treatment with one of the 'neosalvarsan' type of preparations had no 'provocative' effect on the pleocytosis, contrary to a widely expressed belief.

**Clinical examination.** Very remarkable was the almost total lack of nervous symptoms and objective physical signs. Examination was even negative in one patient with a meningeal reaction of such severity that his cerebrospinal fluid was opalescent. Of 99 cases examined clinically, only 20 had symptoms and 8 objective signs. The latter were cranial nerve palsies, the seventh nerve being most frequently affected.

40 cases, of a total of 53 examined, were considered to show an early stage of choroido-retinitis.

**The relation of the W. R. in the serum to the condition of the central nervous system.** Two early cases were observed in which with a negative W. R. in the serum, a pleocytosis was found, and these indicate that a pathological process may develop in the nervous system in primary syphilis while the W. R. is still negative.

Recurrences of nervous symptoms are known to occur in cases in which the W. R. has been rendered negative by treatment. These may be explained by the fact that it is more easy to sterilize the general system than the central nervous system, where spirochaetes may survive a general sterilization and thus bring about relapses. Two such cases occurred in the series. It seems, therefore, that a negative W. R. in the blood does not absolutely exclude involvement of the nervous system, either in early untreated or in treated cases.

In conclusion, they observe that their total of 30 per cent. occurrence of early meningeal reaction (indicating involvement of the nervous system) is smaller than that found by other observers because they have adopted a sounder classification of their cases. Thus of all their cases of over four months' duration, no less than 35 per cent. had abnormal central nervous systems.

(2) In their report to the Medical Research Committee, Fildes and Parnell deal with the response to treatment of cases of syphilis classified as above. The course of treatment adopted consisted in a series of six injections of a 'neosalvarsan' preparation in 0·45 gr. doses. It is their experience that the addition of mercury to such an arsenical course has no beneficial effect. They found that in cases with involvement of the nervous system, as indicated by a pleocytosis in the cerebrospinal fluid, failure to cure was four times as common as in cases without such involvement. Therefore, an abnormal cerebrospinal fluid in early cases before treatment is a strong indication for thorough treatment.

Of 174 cases of syphilis of over 18 months' standing, 143 presented no clinical evidence of syphilis, but 139 of this group had a positive W. R. in the serum. In the remaining four there was no pleocytosis in the cerebrospinal fluid. It seems then that lumbar puncture affords no evidence that cannot be obtained by a blood examination, and Fildes and Parnell conclude that lumbar puncture is of little value as a test of cure when all other methods of examination are negative.

It appears from this work, therefore, that the repeated lumbar puncture advised by Plaut and most German authorities as a control of treatment is not essential, and that initial examination of the cerebrospinal fluid is adequate; that once involvement of the nervous system has been ascertained by its means, it need not be repeated; and that for all practical purposes the Wassermann reaction in the serum is a sufficient guide to the state of the nervous system subsequently. F. M. R. W.

**Weichbrodt** (1). Die Therapie der Paralyse. [**The treatment of general paralysis.**] *Ztschr. f. d. ges. Neurol. u. Psychiat.* (Ref.), 1919, **19**, 192.

**Weichbrodt** (2). Silbersalvarsannatrium und Sulfoxylatpräparat in der Paralysetherapie. [**Sodium-silver-salvarsan and sulphoxylate in the treatment of general paralysis.**] *Deutsche med. Wchnschr.*, 1918, **44**. (*Ztschr. f. d. ges. Neurol. u. Psychiat.* (Ref.), 1919, **19**, 192.)

**Weichbrodt** (3). Weitere therapeutische Versuche bei Paralyse. [**Further researches on the treatment of general paralysis.**] *Deutsche med. Wchnschr.*, 1919, **45**. (*Ztschr. f. d. ges. Neurol. u. Psychiat.* (Ref.), 1919, **19**, 193.)

Using mercury, iodides and salvarsan, Weichbrodt has been unable to produce any improvement in cases of general paralysis, and while with the newer salvarsan preparations, sodium-silver-salvarsan and sulphoxylate, the Wassermann reaction in both serum and cerebrospinal fluid may be controlled, yet clinically no improvement is observed. In fact the patient's condition may become manifestly worse, while these reactions become negative.

He states that, following Wagner von Jauregg's practice, he infected general paralytics with malaria with what he calls 'apparently favourable results' in two instances. F. M. R. W.

**Lambert, S. W. Poisoning by hydrocyanic acid gas, with special reference to its effects on the brain.** *Neurol. Bull.*, 1919, **11**, 93. (*Arch. of Neurol. and Psychiat.*, 1919, **2**, 710.)

During the process of disinfection, a workman was found unconscious in a room filled with hydrocyanic acid vapour where he had been for twenty minutes. Breathing was stertorous, there was a reddish flush on the skin, the temperature was 99, the pulse 120, and the respiration 36. The pupils were contracted and inactive, and the limbs and abdominal muscles rigid.

In a few hours the pulse rate was reduced to 70, there was profuse sweating, incontinence of urine and faeces and the pupils showed an alternating contraction and dilatation.

He lived for sixteen days, coming out of his stupor after a few days, when his hand movements were tremulous and ataxic. The musculature was rigid and for the first half of his illness there were periodical tonic convulsions superadded to this rigidity. Later tonic-clonic convulsions occurred. The knee-jerks were absent, a doubtful extensor plantar response was present for a time and there was difficulty in swallowing. He relapsed into stupor before death, but during the comparatively lucid interval he understood what was said to him, but had some motor aphasia.

The cerebrospinal fluid showed a marked pleocytosis: 200 cells per c.mm. of which 45 per cent. were polymorphonuclear and 55 per cent. lymphocytes.

Blood count showed 6,200,000 red and 15,000 white corpuscles. There was some albumin in the urine.

At autopsy, acute parenchymatous nephritis was found. On section the white matter of the brain was soft and numerous small haemorrhages were found in the white matter of the cerebral hemispheres and in the cerebellum. There were chromatolytic changes in the Betz cells of the motor cortex, gross alterations of the Purkinje cells of the cerebellum and also in the other cells of its cortex. There were numerous scattered small haemorrhages. F. M. R. W.

**Papastratigakis.** Quelques remarques sur l'albuminurie post-paroxystique des épileptiques. [**Post-paroxysmal albuminuria in epileptics.**] *Rev. neurol.*, 1918, i, 65.

From the point of view of albuminuria, epileptics may be divided into two classes; those who have their attacks fasting, and those who have them during the process of digestion. He notes in addition that 70 per cent. of true epileptic fits are associated with temperature changes in the patient; a slight rise in a complete convulsive attack, but commonly a slight fall in petit mal. Albuminuria never occurs unless such a modification of the body temperature is also present.

Of the two classes named above, the first: those whose fits occur during fasting, or rather when no active digestion is proceeding, is the larger, and all of these have both temperature changes and albuminuria. The condition is always transitory and in 85 per cent. of cases associated with acetonuria. He has observed that if a patient who commonly has both temperature change and albuminuria after a fit, happens to have no temperature change after an attack, then albuminuria is also absent. In 85 per cent. of cases the albumin is present in just appreciable amount, but in 15 per cent. in measurable quantity. Albuminuria is found in 90 per cent. of all cases.

The smaller class of patients whose fits occur during active digestion do not altogether fall into line with these observations, in that temperature changes and albuminuria are not always associated, and albuminuria is only found in about 20 per cent. of this type.

The author emphasizes the diagnostic value of his observations in obscure cases of fits. These observations only apply to idiopathic epilepsy.
F. M. R. W.

**Barbé, A.** Le liquide céphalo-rachidien après la mort. [**The cerebrospinal fluid after death.**] *Rev. neurol.*, 1919, i, 607.

Thirty-two subjects of ages ranging from two years to eighty-five were placed in a sitting position and lumbar puncture performed, from 2 to 110 hours after death. The amount of cerebrospinal fluid obtained varied greatly, from 2 to 130 c.c. This variation did not depend upon the age of the subject nor upon the malady causing death. The fluid escaped drop by drop, and was colourless for the first forty hours, after which it was usually of a yellow (citron) colour. Towards the end of the draining, capillary haemorrhages gave a brownish tint to the last few drops. On repeated puncture the fluid was exhausted, and the quantity thus obtained did not definitely exceed that obtained by a single puncture completely emptying the dural sac. From this he concludes that no cerebrospinal fluid is formed after death. He was able to obtain fluid as long as 110 hours after death. All specimens were highly albuminous, especially those taken late, and all contained cellular elements. F. M. R. W.

**Ranson, S. W. Unmyelinated nerve fibres as conductors of protopathic sensation.** *Brain*, 1915, **38**, 381.

**Adrian, E. D. The response of human sensory nerves to currents of short duration.** *J. Physiol.*, 1919, **53**, 69.

(1) In formulating his theory that cutaneous sensation is made up of two forms of sensibility, 'epicritic' and 'protopathic', Head added the conclusion that these two forms are conveyed along anatomically distinct nerve fibres in the peripheral nerves, and that the unit of distribution of the fibres conveying protopathic sensibility is the dorsal root, while that of the fibres along which epicritic sensibility is conveyed is the peripheral nerve.

Starting from these premises, Ranson has reviewed the evidence regarding the identity of these two systems of afferent fibres. His own investigations have revealed that there are great numbers of unmyelinated fibres in the peripheral nerves, and he expresses the view that possibly epicritic sensibility is conveyed along myelinated fibres, while the protopathic form travels along unmyelinated fibres. He finds that there is a very striking parallelism between what has been recently discovered about these afferent unmyelinated fibres, and what are believed to be the facts about the conduction of protopathic sensibility.

Using a new modification of the Cajal silver staining method, Ranson was able to differentiate the myelinated from the unmyelinated elements in spinal nerves. He found that the latter were very numerous, were afferent fibres having their cell body in the posterior root ganglia, and that their distribution was to both skin and muscles.

Considering their possible connexion with the transmission of protopathic sensibility, he points out, (1) that the rate of regeneration of sudomotor and vasomotor fibres, which are unmyelinated, is also that of restoration of protopathic sensibility; (2) that the afferent vagus fibres from the stomach are unmyelinated, and that there is some evidence that the viscera possess a sensibility of protopathic type (Head, Carlson); (3) pain is known to be conducted intraspinally along a path that crosses soon after its entrance into the cord through the grey matter to the opposite half of the cord. Similarly the unmyelinated elements in the posterior roots turn into Lissauer's tract and the posterior horn of grey matter. Certain observations made by Ranson and von Hess suggest that Lissauer's tract may be associated with the conduction of pain impulses.

All this evidence favours the view that unmyelinated fibres may convey afferent impulses of protopathic character, and Ranson suggests, as a working hypothesis, that these relatively undifferentiated fibres of primitive type may well convey this diffuse and primitive form of sensibility.

(2) Adrian has been able to put this view to the proof by utilizing the knowledge that there is a definite relation between the strength of current required to excite a given excitable tissue and the length of time for which it must act. This relation may be expressed in a 'strength-duration curve'.

The time factor for the curve is approximately constant for a given tissue, but varies widely from tissue to tissue. If two excitable tissues be present in any structure their existence may be determined by the complex form of the strength-duration curve, which will be compounded of two different curves.

Adrian endeavoured, therefore, to determine whether he could obtain any evidence, from the strength-duration curve of afferent nerves, of the existence of two excitable mechanisms, and whether the fibres of epicritic and protopathic systems might show a different time factor in their response.

From the observations of Lapicque it appears that the chronaxie (or time factor) of unmyelinated fibre is from 10 to 100 times as long as that of myelinated fibre. Therefore an unmyelinated protopathic system of fibres should show a longer chronaxie than a myelinated epicritic system.

The strength-duration curve for human motor nerve is known, and in estimating it the contraction of a muscle serves as an index of excitation. In the case of sensory nerve the problem is less simple, for Adrian finds that the current excites both nerve ending and nerve fibre; that is, the current acts on two distinct mechanisms. However, it is possible to differentiate them and to identify the second with the nerve ending. It cannot, therefore, be an unmyelinated protopathic fibre system.

Adrian takes an abrupt 'prick' sensation at make and break as the index of excitation of the nerve fibre, and in this way he finds that the chronaxie of human sensory nerve is that of motor nerve. The same result was obtained on excitation of the glans penis, which is regarded as having a purely protopathic sensory innervation. The result obtained does not vary whether a painful or a non-painful stimulus is received.

These results afford no evidence of the existence of two systems of sensory fibres having structural differences, and are not compatible with Ranson's view that pain is carried along unmyelinated fibres. While neither proving nor disproving the hypothesis of Head and Rivers that there are two forms of cutaneous sensibility, Adrian's observations prove that there cannot be great structural differences in the fibres concerned with protopathic and epicritic sensibility. F. M. R. W.

**Vernet, M.** De l'innervation du voile du palais. [**On the innervation of the soft palate.**] *Rev. neurol.*, 1918, i, 1.

During the war, Vernet has observed 15 cases in which a gunshot wound had involved one or more of the 9th, 10th, 11th, and 12th nerves without any lesion of the 5th nerve. In addition he records a case in which the vagus and its pharyngeal branch were sectioned during the course of an operation intended to divide the glosso-pharyngeal. Many of these cases have been published separately under the title of 'le syndrome du trou dechiré postérieur' (vide *Med. Supplement*, 1918, **1**, 261). He now gives a *resumé* of the complete series and draws certain conclusions as to the functions and relationships of the glosso-pharyngeal, vagus and spinal accessory nerves, and finally, discusses the motor and sensory innervation of the soft palate.

The current view is that the muscles of the soft palate derive their motor nerve supply from the motor branch of the trigeminal nerve for the tensor palati, and from the internal branch of the spinal accessory (through the pharyngeal branch of the vagus) for the remaining muscles. The sensory supply has been regarded as derived mainly from the trigeminal nerve through its palatine branches. While the lower third of the pillars of the fauces and the tonsils are thought to be supplied by a plexus (circulus tonsillaris) formed by the trigeminal and glosso-pharyngeal nerves.

While Vernet's observations are in accord with this view of the motor nerve supply of the muscles of the soft palate, they do not agree with that of the sensory innervation. He finds that the sensation of the soft palate is unaffected by fifth nerve lesions, but is always impaired or lost when the vagus or its pharyngeal branch is injured.

This branch of the vagus contains both the motor and sensory nerve supply of this structure; the motor fibres coming from the internal branch of the spinal accessory; and the sensory fibres belonging to the vagus itself. The roof of the mouth derives its sensory supply from the fifth nerve, while the lower thirds of the pillars of the fauces possibly receive theirs from the glosso-pharyngeal. The bulbar portion of the spinal accessory is a purely motor nerve for the soft palate and larynx, while the vagus is analogous to a spinal posterior root and provides the sensory nerve supply for both. Thus, section of the vagus above the ganglion nodosum—that is above the accession to it of spinal accessory fibres—produces no palatal or laryngeal palsy, but only sensory changes in the mucosa overlying these structures.

Vernet also reviews in detail the anatomical, experimental and clinical evidence for this view of the functions of the two nerves.

F. M. R. W.

**Stopford, J. B. Compression of the lower trunk of the brachial plexus by a first dorsal rib.** *Brit. J. Surg.*, 1919, **7**, 168.

Compression of the lower trunk of the brachial plexus by a normal first rib has been described by Thorburn and others in this country, but the fact that ten such cases have come under Stopford's observation within a period of two years indicates that the condition is not so uncommon as is generally thought. Unless its occurrence is recognized, the opportunity of treating cases clinically resembling cervical rib in which X-ray examination is negative, but which may be of this nature, must be lost.

The symptoms found in Stopford's cases closely resemble those of cervical rib. **Pain** of neuralgic type and distributed along the ulnar side of the forearm is a constant feature, though in long-standing cases it may diminish in severity and frequency. This pain is aggravated by circumstances causing depression of the shoulder girdle; such, for example as the wearing of a heavy coat, and is relieved by supporting the arm. **Paresis** and **atrophy** of the intrinsic hand muscles accompany the pain. The interossei and thenar muscles are described as being constantly involved, but the flexors and extensors of the wrist may also be affected. The localized wasting of the thenar muscles so characteristic of some cases of cervical rib, and first pointed out by Kinnier Wilson does not appear to have been present, but rather the ulnar type of wasting which may also be found with cervical rib.

**Objective sensory changes** were present in all but one very early case, and consisted in diminution or loss to pinprick and to temperatures. Touch and the appreciation of simultaneous contacts (compass test) were less frequently and less extensively affected. The distribution of this loss was roughly the ulnar half of the hand and of the distal part of the forearm. **Trophic and vasomotor** disturbances were common over the area of sensory change.

Stopford considers that post-fixation of the plexus, and an abnormally low position of the shoulder, either from excessive descent after birth or from sagging due to muscular hypotonia are the causes of the nerve compression. The bulk of his cases were in women, and in two of the ten there was a traumatic onset. In one of these a prick of a finger heralded the appearance of symptoms, and in some respects this case resembles those described by French writers as 'ascending neuritis', following a trivial injury of a digit.

Before recourse is had to operation, he suggests that an attempt be made to develop the trapezius with a view to maintaining the shoulder at a higher level. For this purpose a month's trial of electrical stimulation of this muscle is recommended. The condition found at operation is the stretching of the combined first and second dorsal roots over a groove on the inner border of the first rib. This is treated by resection, after freeing from muscle, of a portion of the rib. F. M. R. W.

## PATHOLOGY AND BACTERIOLOGY

**Winslow, C. E. A., Kligler, I. J.,** and **Rotberg, W. Studies on the classification of the colon-typhoid group of bacteria, with special reference to their fermentative reactions.** *J. Bact.*, 1919, **4**, 428.

This extensive research presents the results of a detailed study of 160 cultures of bacteria belonging to the colon-typhoid group in the collection of the Department of Public Health, American Museum of Natural History, New York. The tests carried out were agreed upon by a Committee on characterization and classification of bacterial types. The work has special reference to the fermentative reactions of the respective bacteria, the serum reactions not being dealt with. In the main the results agree with those of other workers except in minor details, the paper however should be read by those working specially with the colon-typhoid group of bacteria. As has been the custom for years the main group is divided into two great subdivisions according to the action on lactose, the non-lactose fermenters being again divided into 4 groups while the lactose fermenters are split into 2 groups. The authors therefore resolve all the colon-typhoid bacteria into six main groups according to fermentation tests.

Group I includes the forms of exceedingly low fermentative power which are capable of attacking only the simplest hexoses if they ferment any carbohydrates at all, but are unable to produce acid in mannitol media. In this group the authors place *B. alcaligenes* and the bacillus of Shiga which following Chester they call *B. shigae.*

Group II ferments hexoses and mannitol and either xylose or arabinose, but rarely both. Acid but not gas is produced in the substances attacked. The arabinose-positive forms correspond to the Flexner group of dysentery bacilli and the arabinose-negative forms to *B. typhosus.* Only two strains of arabinose-fermenters occurred in the collection of bacteria examined, viz. a strain isolated by Flexner at Manilla in 1900 and one by Strong in the Philippines. Both were alike in forming acid in glucose, mannose, fructose, galactose, mannitol and arabinose, but not in the other carbohydrates studied. Indol was produced by both. The inability of the culture 'Strong' to ferment maltose and sucrose is given by the authors as evidence of the instability of fermentative powers of Flexner dysentery bacilli. Whether this is a fact it certainly appears true that no authentic saccharose-fermenting 'Strong' type is available at the present time. With regard to the organisms (*B. typhosus*) of this Group II which ferment xylose but not arabinose the authors are in agreement with all other investigators that it is a compact and homogeneous series producing acid but no gas in media containing the hexoses, maltose, mannitol, sorbitol, xylose, and dextrin. There was a slight initial reddening of litmus milk which after two weeks reverted to a neutral or slightly alkaline reaction. It is to be noted that the milk was of the variety known as 'certified', i. e. the very best, freshest and purest it is possible to produce which 'shall not contain on an average mere than 10,000 bacteria per cubic centimetre' (Rosenau). The type *B. typhosus* which the authors studied was the one known as 'Rawlins' a historic English strain with which vast quantities of typhoid vaccine were prepared by Wright and his successors in the Royal Army Medical College.

Group III includes the paratyphoid A and ferments glucose and the other hexoses with the formation of gas; also mannitol, rhamnose and arabinose, but fails to ferment xylose and lactose 'and usually fails to ferment dulcitol'. An acid reaction is produced in milk and may persist for from five days to six weeks. English experience is that paratyphoid A usually if not invariably ferments dulcitol. The type of this group is *B. paratyphosus A* which the authors designate simply as *B. paratyphosus* (reserving the name *B. schottmülleri* for what has hitherto been called *B. paratyphosus B*). In Group III they also place *B. pullorum* described in 1900 by Rettger as the causal agent in bacillary white diarrhoea of chicks. This organism has all the ordinary cultural and fermentative reactions of *B. paratyphosus A* except that it is non-motile 'and fails to attack maltose or dulcitol'.

Group IV including *B. paratyphosus B, B. suipestifer, B. enteritidis* and their allies. They ferment xylose, rhamnose and generally dulcitol. Some of them ferment arabinose. All produce a rather rapid alkalinity in milk, and all differ in agglutinatve reactions from *B. paratyphosus A*. The chief bacteria differentiated by the authors are *B. gallinarum* (Klein) fermenting hexoses, mannitol, maltose, arabinose, xylose, dulcitol, dextrin, rhamnose, sorbitol with acid production but no gas. *B. suipestifer* (xylose + arabinose − inosite − ) *B. enteritidis* (xylose + arabinose + inosite − ) and *B. paratyphosus B* or, as they call it, *B. schottmülleri* (xylose + arabinose + inosite + ). With regard to dulcitol the authors state that *B. suipestifer* generally fails to ferment it, that *B. enteritidis* generally does ferment it, being in this respect like *B. schottmülleri*. *B. aertryck* is not mentioned. The exact relations of Morgan's bacillus (*B. morgani*) are obscure since it possesses the power of forming gas in hexoses only, yet the authors place it in their Group IV. By its limited fermenting powers it is allied to *B. shigae*, by its indol production to *B. dysenteriae* (Flexner) and by the production of gas to the paratyphoids.

Group V ferments lactose, frequently salicin, dulcitol, sucrose, raffinose, glycerol producing a strong acid reaction and a moderate quantity of gas composed in equal parts of $CO_2$ and $H_2$, producing indol, failing to give the Voges-Proskauer reaction, generally motile and not capsulated; never liquefying gelatin. After a careful analysis of the literature on this complicated group, and following Levine (1917) in assigning an important differential value to salicin as compared with dulcitol, the authors recognize the following four distinct species with three varieties in their series of 160 cultures.

1. *B. neapolitanus* (Fraenkel) fermenting lactose, sucrose, raffinose, salicin, and esculin, but not as a rule dulcitol or adonitol, and never starch, glycogen, inulin or dextrin. Milk coagulated. Voges-Proskauer reaction negative.

2. *B. communior* (Durham) differs in failing to ferment salicin, but generally ferments dulcitol; sluggish motile. A variety *B. coscoroba* is non-motile.

3. *B. coli* (Escherich) fails to ferment sucrose and raffinose; generally ferments dulcitol and salicin; sluggishly motile. A variety *immobilis* is non-motile.

4. *B. acidi lactici* differs from *B. neapolitanus* in failing to ferment sucrose, raffinose or salicin and in general fermenting adonitol. A variety *Grünthal* differs from *B. acidi lactici* in being motile. Classifying the whole group according to the action on sucrose and salicin the authors found 15 strains of *B. neapolitanus* (five negative in dulcitol) four of *B. communior* (three negative in dulcitol), 16 of *B. coli* (10 positive in dulcitol) and seven of *B. acidi lactici* (four negative in dulcitol). As showing the necessity for the accurate description of bacteria it is to be noted that in this group the authors found that their collection contained such names as *B. bronchicanis*, *B. astheniae*, *B. anaerogenes* and actually *B. dysenteriae!* when investigation placed them in the group of the 'common colon bacillus'.

Group VI. This differs from Group V in producing a lower acidity in carbohydrate media and a larger proportion of gas of which there are two volumes of $CO_2$ to one of $H_2$. Dulcitol and glycerol are less generally fermented while adonitol, salicin, starch, sucrose, raffinose, and inosite are more frequently attacked. Indol is generally negative; the Voges-Proskauer reaction always positive. Capsulation is frequent and gelatin is sometimes liquefied.

The authors recognize two species. (1) *B. cloacae* (Jordan), fermenting sucrose, raffinose, and salicin, often inosite, but generally not dulcitol, glycerol, starch, inulin, or adonitol. It produces vigorous and complete destruction of carbohydrates which it attacks forming acetyl-methyl-carbinol (Voges-Proskauer reaction). Fails to form indol. Liquefies gelatin slowly.

(2) *B. aerogenes* (Escherich), frequently capsulated; vigorous growth fermenting sucrose, raffinose, salicin, usually glycerol, starch, and inulin,

and sometimes inosite and adonitol, dulcitol and sometimes mannitol. Fails to form indol; gelatin not liquefied; Voges-Proskauer reaction positive. This microbe represents the extreme of fermentative power of the colon-typhoid series and both it and *B. cloacae* are alkaline to methyl red as was shown by Clark and Lubs (1915).

The authors of this laborious research have gone fully into the whole question of the value of carbohydrate fermentation tests as a basis for bacterial classification including the question of mutation, the chemistry of the fermentative reactions of the colon group emphasizing the importance of the work of Harden at the Lister Institute. They also consider the relation between the structural formula of the carbohydrates and their decomposition, and they deal with the progressive changes of reaction in carbohydrate media and their significance. The chief point on which they differ from English workers is with regard to the differential value of dulcitol as an ingredient of media. They doubt whether this alcohol should be given a prominent place in a system of classification in that it shows less correlation with other properties than any other carbohydrate and under experimental conditions shows the most marked tendency to spontaneous variations. In agreement with Kligler (1914) and Levine they consider that salicin has a superior value for the separation of individual species within the group. W. B.

**Andrewes, F. W.** and **Inman, A. C.** **A study of the serological races of the Flexner group of dysentery bacilli.** *Med. Res. Comm., Special Rep. Series*, No. 42. 1919.

This report deals with the results of work undertaken in connexion with the war. It had been a common experience in laboratories on all fronts to meet with mannite-fermenting bacilli from dysentery cases which failed to agglutinate with standard 'Flexner' and 'Y' sera. A large number of strains, including as many 'inagglutinable' ones as possible, were collected from various sources at St. Bartholomew's Hospital and submitted to serological examination in order to determine how many serological races could be defined.

The writers adopt an arbitrary definition of Flexner's bacillus, which they hold to include the 'Y' strains. They exclude the forms fermenting dulcite and also those giving permanent acidity with lactose, referring such forms to distinct species. They further exclude forms giving heavy acid-agglutination by Michaelis's technique. They defend such exclusion on grounds of serological unconformity in addition to cultural difference, without disputing that such excluded types may be concerned in the causation of dysentery.

The total number of strains which conformed to this definition was 116. Rather more than half came from the Western front, but in smaller numbers were strains from the various Eastern fronts, and from various parts of the world. Standard cultures from British, European, and American laboratories were included for purposes of comparison, but Kruse's types were not available. The collection appeared to be a representative one.

The methods employed were the customary ones of agglutination, agglutinogenesis and absorption of agglutinins; Dreyer's technique with formalinized broth cultures was employed throughout the essential stages of the work, but the emulsions were necessarily unstandardized as regards agglutinability. The writers have throughout adopted the principle of expressing their results in percentage form, and they make use of coloured diagrams to set them forth.

Twenty-one strains were chosen for elaborate study, sixteen of these being unknown and unselected, while five were known standard strains. Fourteen of these strains were from carriers whose blood agglutinated the bacilli isolated, and a preliminary grouping was suggested by the cross-agglutination of the selected strains with human sera from these cases. Rabbit sera were then made, fifteen in all, and cross-agglutination of the 21 strains with the 15 sera was carried out. A very definite grouping was then apparent: four serological races could be recognized, apart from the 'Y' strains, which, seemed to form a fifth group. The diagrams given illustrate the degree of specificity of these races and the extent of group-agglutination amongst the several races.

The writers adopted the idea of 'multiple antigenic components' as a working hypothesis, and their aim was to ascertain how many such components could be defined in the Flexner group. The evidence from agglutination and agglutinogenesis suggested four such components, and the next step in the investigation lay in the confirmation of this conception by the absorption test.

The evidence obtained showed that the agglutinin corresponding to each supposed component could not be absorbed, or could be only very partially absorbed, by any of the other components, even when the serum of one race was heavily absorbed by bacilli of the other three races combined.

The writers therefore consider that they have established the existence within the Flexner species, of four antigenic components, the predominance of one of which in a given race confers a distinct stamp, as a serological race. They adopt the nomenclature suggested by a committee of bacteriologists appointed by the War Office Committee on Dysentery, calling these races V, W, X, and Z respectively. They further describe two intermediate races as VZ and WX, on evidence suggesting an intermediate antigenic constitution.

There remains the Y race, the type of which was obtained from Washington. Four Y sera were made from separate strains and numerous cross-agglutinations and absorptions were carried out. All of the four previously defined antigenic components were recognizable in the Y strains, but the writers were unable to define any fifth component to account for the serological peculiarities of this race. They suggest that the Y race may be a more primitive one in which the antigenic components are more evenly balanced.

This classification into five races, apart from the intermediate ones, is shown to be in harmony with that independently reached by Gettings and by Murray. Both these observers reached their results by the absorption test, but failed by agglutination alone. Andrewes and Inman attribute the fact that they were able to effect a differentiation by agglutination to the use of Dreyer's technique.

The extended series of 116 Flexner strains was examined by agglutination with the type sera which had been made, and all but eight could be referred to one or another group. Later experience in France showed that the great majority of the strains which had previously proved inagglutinable could readily be referred to their proper race. The difficulties had arisen because the Z and X races had not previously been recognized.

Similarly the serodiagnosis of Flexner dysentery was found much more satisfactory when Z and X emulsions were added to the range of those employed: in 43 cases of 'clinical dysentery' a positive result was obtained by serodiagnosis in 77 per cent.

The paper is illustrated by 17 coloured plates, and the full data of all the experimental work are given in an appendix. F. W. A.

**Hirsch, P.** Versuche über Entgiftung von Ruhr- (Shiga-) Bazillen zwecks Impfstoffgewinnung. [**Attempts at detoxicating dysentery (Shiga) bacilli for the purpose of protective inoculation.**] *Ztschr. f. Hyg. u. Infektionskrankh.*, 1919, **89**, 176.

This paper contains minute experimental details of attempts to produce hypotoxic Shiga vaccines for the purpose of immunizing against dysentery. The author finds that the toxicity of a Shiga vaccine depends on the height of the thermic death-point. Saline suspensions of living shiga bacilli killed at 52° C. are less toxic than when the heat has been maintained at 65° C. Tricresol has no influence on the toxicity. Iodine trichloride as well as trypaflavin diminish the toxicity, whereas vuzin and carbon dioxide have no such effect. Guinea-pig's complement renders both killed and living cultures less toxic. In spite of the loss of toxicity, the vaccines were antigenic. The author however has not been able to work out a suitable vaccine for human beings. W. B.

**Felsenreich, G.** Über ein Verfahren der kulturellen Elektion von Paratyphus B-Bazillen auf stark alkalischen Nährboden. [**On a strongly alkaline elective medium for the growth of B. paratyphosus B.**] *Ztschr. f. Hyg. u. Infektionskrankh.*, 1919, **89**, 88.

By a series of experiments the author found that *B. paratyphosus B* in faeces can tolerate a high degree of alkalinity and can be isolated readily and grow characteristically in a modified endo medium containing 12 per cent. of a solution of normal caustic potash past the neutral phenolphthalein point. On such an alkaline medium the normal faecal flora is almost totally suppressed. The colonies of *B. paratyphosus B* are slimy and colourless with a whitish centre. The medium is recommended for the search of *B. paratyphosus B*, and it is said that it yields results from 500–6,000 times more positive than other methods. Exact details of the manufacture of the medium should be consulted in the original.

W. B.

**Lewy, F. H.** u. **Schiff, E.** Eine dritte Form des Paratyphus. (Paratyphus B, Weil, Paratyphus Ersindjan, Neukirch.) [**A third form of paratyphoid fever. (Paratyphoid B of Weil, Paratyphoid Ersindjan of Neukirch.)**] *Berl. klin. Wchnschr.*, 1919, **56**, 1059.

Following Neukirch and Weil the authors consider it necessary to recognize a new type of paratyphoid which they designate Paratyphoid B, Weil, or Paratyphoid Ersindjan, Neukirch, from the fact that the latter writer had isolated the organism in Ersindjan (Ersingan, Armenia) in 1915. Weil and Saxl observed it in Volhynia and Albania, and Dienes and Wagner in 'eastern Europe'. Lewy and Schiff found it widely spread and almost endemic in Asiatic Turkey and Palestine. Up to the commencement of the retreat, in September 1918, Schiff and Schilling saw 80 cases and later, 25 cases in the military hospital at Haidar Pasa (Scutari). Clinically there was marked remitting temperature with bacteriaemia and pyaemic abscesses. Anatomically the principal lesions were nephritis, enteritis, hepatitis with abscesses, haemorrhages in all serous membranes, and septic spleen. No spots or ulcers of the intestines were observed. As was pointed out by Neukirch (*Ztschr. f. Hyg. u. Infektionskrankh.*. 1918, **85**, 103) the cultures are like *B. paratyphosus B*, but differ serologically. According to Lewy and Schiff the method of transmission is uncertain but does not appear to take place by pigs. The complete bacteriological investigation is reserved for a future publication. W. B.

**Rasmussen Reerstorp, A.** Undersøgelser over Forekomsten af Bakterier af Paratyphus-Gruppen i Tarminholdet hos sunde Svin. [**Researches on the occurrence of bacteria of the paratyphoid group in the intestinal contents of healthy pigs.**] *Meddelelser fra d. Kgl. Vet. og Landbohøjskoles Serumlab. Kjøbenh.* 1919, No. **62**.

This is a research carried out to determine the incidence of non-lactose fermenting bacteria of the paratyphoid group in the intestines of healthy pigs in Denmark. The contents of the small intestine or caecum were examined in 105 animals by inoculation on litmus-lactose-agar either directly or after treatment with petrol ether. In 30 pigs no paratyphoid-like bacteria were found, but from the remaining 75 animals 250 suspicious strains were raised and subjected to fermentation and agglutinative tests. The fermentative tests allowed the organisms to be subdivided into 8 types, of which type I included no fewer than 212 strains. The characters of this group were acid and gas production in dextrose, maltose, arabinose, xylose, rhamnose, and mannitol, but no fermentation in lactose, saccharose, sorbitol, dulcitol, or adonitol. The remaining 7 types were found in only a few instances, viz. type II, 3 strains; type III, 6 strains; type IV, 15 strains; type V, 7 strains; type VI, 2 strains; type VII, 2 strains; and type VIII, 3 strains. It is of interest to note that type I resembled *B. suipestifer*, Voldagsen, but differed in the fact that it was able to ferment mannitol with acid and gas production. Type V corresponded in its reactions to *B. aertryck* and *B. paratyphosus B.*

All the strains isolated were tested with strong agglutinating sera prepared by inoculating horses with *B. paratyphosus A*, *B. paratyphosus B* from calves, *B. aertryck*, *B. suipestifer*, Voldagsen, or *B. paracoli* from calves. There was slight agglutination with paratyphoid A and paracolon sera but none with the other sera, from which the author infers that true *B. paratyphosus B*, *B. suipestifer*, Voldagsen, were not among the bacilli isolated by him. The author speaks well of Bierast's petroleum ether method of preparing suspensions from the intestinal contents. A small particle of faeces is carefully rubbed up in 5 c.c. sterile saline and then made up to 10 c.c. This is placed in a strong glass tube and 10 c.c. of petrol ether (B. P. 40° C.) are then added. A rubber cork is fitted and the petrol-faecal emulsion is agitated in a shaker for 1½ hours, being then left at room temperature for a period of 1½–2 hours. A drop of the deposit being withdrawn by a Pasteur pipette is spread over the lactose-litmus-agar plates. It appeared to the author that the growth of *B. coli* was considerably lessened and the chance of finding non-lactose fermenters enhanced. W. B.

**Christiansen, M.** Bacillaer Dysenteri hos Aber. [**Bacillary dysentery in monkeys.**] *Meddelelser fra d. Kgl. Vet. og Landbohøjskoles Serumlab. Kjøbenh.*, 1918, **55**.

In the summer of 1916 an epidemic of paradysentery broke out among the monkeys of the Zoological Gardens of Copenhagen. The infection was undoubtedly introduced by an orang-outang which had come from the East and which was ill on its arrival. Scabies was diagnosed and believed to be the whole trouble, and after treatment the animal was placed along with three grown-up chimpanzees. About a week later the orang became very ill with a bloody diarrhoea and died in a few days. Shortly after, two of the chimpanzees developed similar symptoms and the third was affected later. All three died. The keeper who nursed these animals developed severe dysenteric symptoms, but recovered. Unfortunately his faeces was not examined bacteriologically. Shortly after, his wife was seized with dysenteric symptoms and died, most probably of peritonitis following a perforation of the bowel. Paradysentery bacilli were found in her faeces and similar bacilli were found in large numbers in the orang-outang and one of the chimpanzees. In the cages near the affected anthropoids dysentery broke out among macacus and rhesus monkeys, but was somewhat slower in developing. In nine dead macaques the autopsy revealed inflammation localized in the colon and caecum. It was of a diphtheritic character and the mucous membrane was extensively ulcerated. Some of the lesions showed incipient healing and cicatrization. In five of the macaques paradysentery bacilli were found in the colon, but none could be found in the four other fatal cases, which presented severe pathological changes, especially of a chronic character. One culture from a chimpanzee and two from rhesus monkeys were carefully examined and compared with paradysentery bacilli from man and belonging to Sonne's types I and II. All the three strains from monkeys fermented dextrose, mannose, galactose, fructose, maltose (after 36 hours), saccharose (after 5-6 days), raffinose, trehalose, arabinose, mannitol, and dextrin, but had no effect on cellobiose, lactose, xylose, rhamnose, dulcitol, adonitol, sorbitol, erythritol, glycerol, salicin, or cirulin. The two human strains behaved in similar manner, but differed with regard to raffinose and rhamnose, and one of them also with regard to saccharose. The agglutination reactions of the monkey strains were identical and corresponded to Sonne's type II, (see this Journal 1919, **1**, 348). The culture from the chimpanzee proved to be toxic to rabbits when inoculated intravenously. W. B.

**Hecht, Erich.** Über die Pathogenese des Typhus abdominalis. [**On the pathogenesis of typhoid fever.**] *Med. Klin.*, 1919, **15**, 1168.

Although this paper contains no original observations it is of importance as dealing critically with the vexed question of the essential nature and pathogenesis of typhoid fever. For the first few years after the discovery of the typhoid bacillus the general consensus of opinion was that typhoid fever was primarily an intestinal disease, the general symptoms being due to intoxication. With the publication of the work of Sanarelli and others from 1894 onwards, the view, however, rapidly gained ground that the disease was, essentially and primarily, a generalized infection—a septicaemia—and that the intestinal lesions were secondary. In other words, there were and are two opposing views, viz. an *enterogenic* and a *haematogenic* origin, the latter including also a lymphogenic origin as well as haematogenic *sensu strictiori*.

The principal facts which appear to support the haematogenic view are: (1) the existence of numerous cases in which it is alleged that there were no intestinal lesions, (2) the existence of bacteriaemia very early in the history of the case, and (3) the conditions of the bacillus as it grows in the bowel.

The question of haematogenic origin, including as it does the consideration of cases without involvement of the mucous membrane of the bowel, was made the subject of exhaustive critical inquiry in 1912 by A. Posselt ('Atypische Typhusinfektion. Typhus ohne Darmerkrankung' in Lubarsch-Ostertag, *Ergebn. d. allg. Path.*, 1912, Jahrg. xvi, Abt. 1, pp. 184–340), the present author working along the same lines. It is possible to distinguish three categories of cases of typhoid fever without intestinal lesions, viz. (1) typhoid sepsis in the foetus or newly-born infant the typhoid bacilli having traversed the placenta, (2) typhoid sepsis in the adult, (3) typhoid fever with lesions in the meninges, liver, &c., but not in the bowel.

A pure typhoid sepsis in the foetus or newly-born infant is not denied, and the adequately investigated cases have been well summarized by Posselt (l.c. 248). A similar sepsis in the adult has however been denied, as well as typhoid in organs and tissues exclusive of the intestine. From the examination of 170 cases in the literature, Posselt has excluded 115 as being insufficiently described, leaving 55 which he has arranged as follows:

| | | |
|---|---|---|
| (1) | Primary typhoid septicaemia . . . | 28 cases |
| (2) | „ „ meningitis . . . | 3 „ |
| (3) | „ „ lesion of lungs . . | 2 „ |
| (4) | „ „ „ pleura . . | 1 „ |
| (5) | „ „ „ spleen . . | 3 „ |
| (6) | „ „ „ kidney . . | 1 „ |
| (7) | „ „ „ joints . . | 1 „ |
| (8) | „ „ „ liver and ducts . | 16 „ |

In a number of instances it has been expressly stated that the intestinal lesions may be very slight or actually healed, and Gräff (1918) one of the most recent writers on the subject, considers that a macroscopic estimate of the existence of lesions is insufficient. Hecht considers as a result of his critical analysis of the data, that a pure typhoid sepsis without intestinal lesions has been proved in the foetus but has only been rendered probable in the adult.

The second chief support for the haematogenic hypothesis is the fact, as shown by many investigators during the last twenty years, that bacilli are almost regularly found in the blood very early in the disease. Indeed there are the important observations of Conradi (1907), who actually found the bacillus in the blood in two cases in the neighbourhood of enteric patients. These two persons were well, but shortly afterwards were attacked by the disease, the blood being proved to be infective in the incubation period. It has been alleged however that the bacilli do not actually reproduce themselves in the blood, being merely carried there from some focus. Gräff has also pointed out that, were the haematogenic view correct, one should expect that the lesions of the viscera would be equal in degree, but such is by no means the case. The accumulated facts on general and local disposition are opposed to Gräff's conclusion.

With regard to the conditions of vegetation of the typhoid bacilli in the bowel it is known that, in contrast to the high incidence in the blood early in the disease, typhoid bacilli are found in the faeces in only about 25–30 per cent. during the first week. In recent years it has been customary to believe that the bacilli, having entered the blood, are transported especially to the lymphatic organs, spleen, and marrow, and to the bile descending from the liver, or it may be from the vessels of the gallbladder. From the bile large numbers of bacilli descend to the intestine and produce the characteristic lesions in there.

The upholders of the enterogenic theory believe that intestinal lesions are always present, even if they may be minute, that they occur early, and that it is from this as a primary focus that they invade the blood. From what has been said above, however, it is probable that an enterogenic origin is not a regular feature of enteric fever. That the microbe enters the body by the alimentary canal must be accepted as almost if not quite constant. In a certain number of cases it has been made highly probable that the virus may enter by the tonsils and lymphatic ring of the throat. In a careful consideration of the pros and cons of the whole question the author believes that, after their entry into the body by the alimentary canal the bacilli pass into the blood directly or indirectly after traversing the lymphatics and at the same time produce a primary intestinal lesion. The extent of the intestinal lesions or their absence may be explained by the great individual variations in disposition. W. B.

**Fukuhara, Y.** and **Yoshioka, M.** **A new method of testing antityphoid serum.** *J. Immunol.*, 1919, **4**, 285.

Although practical experience has shown that certain anti-infectious immune sera are of considerable value therapeutically it is well known that no antibodies have hitherto been discovered whose quantitative determination represented the measure of such therapeutic value. In attempting to estimate the antibody content of the serum under investigation, it has been customary, since Pfeiffer's classical researches, to inject the serum in varying quantities combined with ten lethal doses of a living virulent culture of the microbe. The present authors find that the virulence titre of living typhoid bacilli is very variable according to the strain, and that no quantitative relationship exists between the virulence and the combining power with relation to the protective unit of the antiserum. For this reason the lethal dose of a typhoid culture is not a reliable measure of the protective powers of an antityphoid serum. They propose to substitute a new measure whereby the L+ dose of a typhoid culture is determined when mixed with an arbitrary protective unit of standard antiserum. With this L+ dose the serum to be tested is mixed in varying quantities. The largest amount of serum which will just permit the death of a 250 grm. guinea-pig within 24 hours after the mixture has been injected into the peritoneum is taken as the protective unit. The value of any antityphoid serum is expressed by the number of such protective units contained in

1 c.c. of the serum. Any strain of typhoid culture can be used for the test. The virulence control is not important. The authors consider that by means of their suggested test it will be possible to make a quantitative comparison of antityphoid sera prepared at different laboratories with different typhoid cultures. W. B.

**Fukuhara, Y. A new method of testing antitoxic dysentery serum.** *J. Immunol.*, 1919, **4**, 299.

The testing of antitoxic dysentery sera has been carried out either by injecting mixtures of the toxin and antitoxin as recommended by Todd, Vaillard and Dopter, Kolle, and others or by introducing the two reagents separately, a method utilized by Kraus and Doerr, who injected four lethal doses of the toxin into the marginal vein of one ear of rabbits and varying quantities of the serum into the vein of the other ear. The experience of the present author is that this method is unreliable and he prefers the inoculation of toxin-antitoxin mixture. Only certain of the dysentery strains are suitable for the production of soluble toxin; with one particular strain a toxin was obtained of which 0·01 c.c. to 0·005 c.c. injected intravenously killed 1,500 grm. rabbits within five days. A serum was arbitrarily elected as a standard, the unit adopted being that amount which neutralized 100 minimal lethal doses of a particular toxin. For testing of other antidysenteric sera the so-called L+ dose of dysentery toxin was adopted as the smallest amount which, when mixed with the antitoxin unit and injected into rabbits intravenously, caused the death of the animal within from four to five days. This L+ dose of toxin was subsequently employed to determine the antitoxic unitage of newly prepared antisera. The standard serum is prepared in vacuum tubes as in the preservation of the diphtheria unit. The author confirms the old observation of Todd that differences in temperature exert a notable influence on the course of the toxin-antitoxin reaction. If the dysentery toxin behaved like diphtheria toxin it should be expected that in the course of time the minimal lethal dose would increase in quantity while the antitoxin combining power would remain unchanged, i. e. the value of L+ would be stable. Such however is found not to be the case. In an experiment quoted the lethal dose increased from 0·009 c.c. to 0·08 c.c. while the L+ dose rose from 1 c.c. to 7·5 c.c. in a little over 15 months. In the terminology of Ehrlich both the 'toxophoric' and 'haptophoric' groups were involved in the deterioration. W. B.

**Dold, H.** u. **Chen Yü Hsiang.** Über das Verhältnis der tatsächlichen zur theoretisch möglichen Gefahr der Keimübertragung durch Fingerberührungen (illustriert am Typhusbacillus). [**On the relation between the actual and theoretically possible danger of transmission of bacteria by finger contact (illustrated by typhoid bacilli).**] *Ztschr. f. Hyg. u. Infektionskrankh.*, 1919, **89**, 266.

Modern investigations are believed to show that contact infection in typhoid fever is common. From a study of 978 cases Frosch estimated that 642 = 65·6 per cent. were contact infections; v. Drigalski estimated it at 64·7 per cent., and Klinger, in 1,397 cases studied, believed that contact infection, especially from soiled hands, occurred no fewer than 1,315 times = 95 per cent. Of course these figures were based on probabilities rather than demonstrated facts. Indeed very few direct experiments on the subject have been made. This hiatus in our knowledge the present authors try to fill up by making definite experiments to see how many typhoid bacteria can develop when a plated medium (endo) is inoculated directly from the fingers intentionally infected with typhoid cultures. If an equal quantity of typhoid bacilli be spread on plates with a glass rod on the one hand and the end of the finger on the other, the number of bacteria which develop from the second form of inoculation is considerably less than with the glass rod. If typhoid bacteria to the number of 275 are applied to the ball of one finger and after a minute the infected finger is brought into contact with another finger, the immediate inoculation of an agar plate by means of the second finger yields negative results. If a number (580) of typhoid bacteria are placed on the ball of a finger and the infected digit is then brought into contact with such inanimate objects as glass, wood, paper, leather or metal, the plates inoculated from these objects remain sterile. If the inoculation of typhoid is increased a point comes when plates can be successfully inoculated from the contaminated finger although there are many fewer colonies than might be expected. A good deal depends on the condition of the skin and the vitality of the organism employed. In any case the practical results go to show that the danger of transmission from the infected finger is much less than might theoretically be supposed.

W. B.

**Duval, C. W.** and **Harris, W. H. The antigenic property of the Pfeiffer bacillus as related to its value in the prophylaxis of epidemic influenza.** *J. Immunol.*, 1919, **4**, 317.

This trial of protective inoculation against influenza was carried out at the height of the epidemic in New Orleans during the autumn of 1918. The writers, prior to the use of the vaccine, had satisfied themselves that *B. influenzae* (Pfeiffer) played an important rôle in the clinical disease (*Med. Science* 1919, **1**, 531). More than 5,000 persons were vaccinated with a specially prepared protein suspension of the Pfeiffer bacillus.

The vaccine was prepared from influenza bacilli grown upon the surface of a solid nutrient agar medium, 0·6 per cent. acid against phenolphthalein, to which was added, before allowing to solidify, 1 per cent. sterile, washed human erythrocytes. Inoculation of large Erlenmeyer flasks of the medium was made by flooding the surface with a fresh saline suspension of *B. influenzae*, introduced by means of a pipette. Incubation was then continued for 48 hours at 37° C., at the end of which period the growth was carefully washed off with sterile saline. The suspension of bacilli was then killed by saturation with chemically pure chloroform. The chloroform was allowed to act for 10 to 15 minutes, which was quite sufficient to kill the bacilli without injury to the antigenic properties. The chloroform was then allowed to settle and the supernatant suspension of killed bacilli transferred to small flasks loosely plugged with cotton-wool. These flasks were placed at 37° C. for one hour to drive off the remainder of the chloroform.

For inoculation only freshly prepared vaccine (not more than a week old) was employed. The dose for adults was approximately *one billion* (American) (i.e. 1,000 million) for the first injection, one half the amount for the second, and one billion for the third, given at three days' interval.

The majority of the vaccinated individuals were employees in large commercial houses, banks, and factories of the City of New Orleans. The efficacy of the vaccine was thoroughly tested, as eight weeks after the subsidence of the epidemic a recrudescence occurred. The general results obtained are given below in tabulated form.

| | No. of persons vaccinated. | Vaccinated developing Influenza. | | | Constitutional Reaction. | | |
|---|---|---|---|---|---|---|---|
| | | No. | Per cent. | Protected per cent. | Severe. | Mild. | None. |
| One injection | 118 | 29 | 24 | 76 | | | |
| Two injections | 346 | 28 | 8 | 92 | 30 | 60 | 10 |
| Three injections | 2,608 | 45 | 1·7 | 98·3 | | | |
| Total . . . | 3,072 | 102 | 3·3 | 96·7 | | | |

| | | Controls developing Influenza. | | | Incidence of Disease. | | |
|---|---|---|---|---|---|---|---|
| | | No. | Per cent. | Protected per cent. | Vaccinated per cent. | Unvaccinated per cent. | Difference per cent. |
| Controls (persons not vaccinated) | 866 | 375 | 41·6 | 58·4 | 3·3 | 41·6 | 38·3 |

The controls consisted of 866 individuals who refused vaccination. Their occupations and daily environments were identical with those who were vaccinated. The authors, however, recognize that the numbers dealt with are too small to draw any sweeping conclusions as to the degree of absolute protection afforded and to the duration of the immunity.

Some degree of reaction was observed in the majority of cases inoculated. In 30 per cent. of the cases the constitutional effects were such as might be regarded as severe. In these the symptom complex was that of an early influenza toxaemia only, the symptoms subsided in from 6 to 12 hours. The close analogy between the above symptoms and those of the natural infection strongly suggest a close relationship between the clinical disease and the artificial toxaemia produced by the injection of *B. influenzae* vaccine.

The writers conclude by saying that 'While our total number of vaccinated persons is too few to permit of the statement that *B. influenzae* vaccine is a constant specific in the prevention of the disease clinically known as epidemic influenza, it can be said, however, that the results are interesting and significant from the standpoint of prophylaxis'. From agglutination and complement fixation tests the duration of the specific antibodies in the blood varies within wide limits. In many instances, however, antibodies were demonstrated six months after vaccination.

J. McI.

**Valentine, Eugenia** and **Cooper, Georgia M. On the existence of a multiplicity of races of B. influenzae as determined by agglutination and agglutinin absorption.** *J. Immunol.*, 1919, **4**, 359.

The existence of multiple races of *B. influenzae* has been urged by W. H. Park and the writers of this article as evidence against its being an important aetiological factor in epidemic influenza. In this work, which was carried out in the Laboratories of the Department of Health, New

York City, it is claimed that there is a multiplicity of strains, and that identical strains are infrequently encountered. The observations are based on agglutination and absorption tests. A summary of their results is given in tabulated form.

| Series. | No. of strains tested. | No. of anti-sera. | No. of other anti-sera. | Findings. |
|---|---|---|---|---|
| Autopsy | 10 | 10 | 7 | All strains found to be distinct races. |
| Miscellaneous | 73 | 0 | 18 | No two strains found to be identical. |
| Marines | 54 | 4 | 14 | Two strains from different individuals found identical. |
| Hebrew orphans | 28 | 5 | 16 | Two strains identical. |
| Family | 6 | 6 | 10 | All strains found to be distinct. |

The above findings when looked at critically seem improbable and want confirmation. Even if the above results are accepted then it has to be considered to what extent one is justified in regarding these differences as being significant.

Recent work on the pathogenic anaerobes suggests that such methods of differentiation are hyperspecific, in that strains differing widely in agglutination reactions proved to be one and the same bacillus when tested by the toxin-antitoxin method, while the immune serum of one protects equally against any of the other strains. J. McI.

**Barber, M. A.** (1). **A study by the single cell method of the influence of homologous anti-pneumococcic serum on the growth rate of pneumococcus.** *J. Exper. M.*, 1919, **30**, 569.

**Barber, M. A.** (2). **Antiblastic phenomena in active acquired immunity and in natural immunity to pneumococcus.** *J. Exper. M.*, 1919, **30**, 589.

For a long time it has not been possible to ascertain the exact method by which certain immune sera produce their undoubted effects on the homologous microbes. Sclavo's anti-anthrax serum is a case in point. It is admitted on all hands that such a serum is not more bactericidal than a normal serum. With reference particularly to anti-anthrax serum Ascoli long ago (1908) developed the idea that it acted in what he called an 'antiblastic' manner—a kind of anti-metabolic action on the bacilli represented in part at any rate by the inhibition of capsule formation. The action of anti-pneumococcic serum falls in the same category as Sclavo's serum, and the present paper represents the attempts of Barber by his beautiful single cell technique to study the problem more exactly than had hitherto been possible. In preliminary experiments he estimated the generation time of the pneumococcus at 30 minutes in a minute hanging drop. On placing singly pneumococci in homologous or heterologous immune sera, he found no delay or inhibition of the generation time. Neither did the addition of complement add any further light on the question. In the passively immunized mouse the growth of extra-cellular homologous pneumococci in the peritoneum proceeded at a normal rate until they were engulfed by phagocytes. The serum therefore showed no 'antiblastic' effects.

In the second paper experiments of a similar type are described in which not the serum but the 'whole' blood was used. The blood in question was of such a titre that 0·2 c.c. protected mice against 10,000 minimal lethal doses of living culture of the homologous pneumococci. In hanging drops containing single cocci 'whole' fresh blood, coagulated plasma or serum of immunized horses added directly had considerable inhibiting action on the growth of the cocci. The inhibiting action of normal fresh blood or plasma was found, however, to be just as effective. The property thus would not seem to be of importance in acquired immunity in the horse. In the 'whole' fresh blood of the rabbit no 'antiblastic' effect was observed. The 'whole' fresh blood of the pigeon—an animal naturally immune to pneumococci—showed no inhibitory effects on this microbe. W. B.

**PARKER, JULIA T. The poisons of the influenza bacillus.** *J. Immunol.*, 1919, **4**, 331.

This paper from the Department of Bacteriology, Columbia University, New York, deals with an attempt to solve the nature of the poisonous products formed in liquid cultures of *B. influenzae* (Pfeiffer). In a previous communication the authoress had shown that filtered blood-broth cultures of *B. influenzae* were toxic for rabbits, but the nature of the toxin was not ascertained. It was also claimed that the sera of rabbits inoculated with the filtered cultures possessed neutralizing powers. In the present article protocols are given of the neutralizing power of the sera of rabbits immunized against the toxin. But the experiments would have been more convincing had the normal sera controls been more exacting. Extracts of vaccines of *B. influenzae* were also examined as regards their toxicity.

As the result of her experiments the writer in conclusion says that she has been unable to ascertain the true nature of the broth poison of *B. influenzae*. Certain features are suggestive of a true toxin while others are not. It is possible, however, that the toxin is a combination of two poisons; the first a soluble toxin, which is produced during the growth of *B. influenzae* and can be neutralized by the antiserum in multiple lethal doses; the second a non-neutralizable, thermostable filterable poison which is also found in the bacteria extracts. This would explain why it is possible only in about 50 per cent. of the cases to neutralize three minimal lethal doses of the poison of filtered broth cultures. The fact that rabbits can be immunized, however, to withstand four to five lethal doses of the broth filtrate poison excludes the possibility that the noxious substance is a proteotoxin (proteid degradation product). J. McI.

**ALBERT, HENRY and KELMAN, SARAH B. The pathogenicity of Bacillus influenzae for laboratory animals.** *J. Infect. Dis.*, 1919, **25**, 433.

The authors describe the effects of the inoculation of living cultures or filtrates from cultures, of *B. influenzae*, on rabbits, guinea-pigs and mice. The details given are short but they tend to show that guinea-pigs are more susceptible than rabbits or mice. The virulence varies with the culture. After injection, influenza bacilli are as a rule rapidly destroyed. Following injection into the peritoneum they may appear in the blood. A toxin is produced which is fatal almost as rapidly as are living cultures, but its nature was not determined. W. B.

**WOLLSTEIN, MARTHA. Pfeiffer's bacillus and influenza. A serological study.** *J. Exper. M.*, 1919, **30**, 555.

This paper deals with the aetiological rôle of *B. influenzae* as far as can be determined by such serological tests as agglutinins, precipitins and complement fixation. Agglutination reactions were unsatisfactory as it was difficult to obtain uniform emulsions of the bacilli. Ultimately, bacilli grown on boiled-blood-centrifugate-agar were suspended in distilled water, the serum being diluted with saline. The mixtures were kept at 55° C. for two hours and then over-night at room temperature. The sera of five normal human adults did not agglutinate Pfeiffer's bacillus at all while two other normal sera reacted in dilutions not exceeding 1 : 10. Sera from 11 patients were tested during the second week of illness. Five were recovering from mild pneumonia and the sera of two of these agglutinated in dilutions of 1 : 100 while the remaining three agglutinated in dilutions not higher than 1 : 40. Six sera from cases of uncomplicated influenza contained no agglutinins in two instances and reacted in dilutions of 1 : 40 in four others.

Complement deviation. Antigens were made in two ways, and it was found that, of 22 strains examined, seven yielded strong antigens, eight were weak, and in seven no antigenic power was demonstrable. The sera of four normal adults possessed no complement-fixing properties at all.

On the other hand fixing substances were found in the sera of influenzal patients at the end of the first week, increasing during the second week, and still demonstrable at the end of three or four weeks. At the end of the second month after an attack of influenza complement-fixing antibodies were strongly present except in one case.

In two instances the sera of four carriers were negative. One inoculated and one non-inoculated carrier reacted strongly. One of the negative, non-inoculated carriers on being subsequently inoculated yielded a positive fixation reaction for three of six antigens used. Monovalent immune rabbit sera were made with 10 strains of *B. influenzae* and all fixed complement in the presence of antigens which were homologous or heterologous. Normal rabbits were negative.

Precipitins were demonstrable in the serum of every convalescent examined and they were absent in normal sera. Antigens made from homologous strains gave no more marked precipitins than did those made from heterologous strains.

An important part of Miss Wollstein's paper deals with the question of toxic filtrates from influenzal cultures. Filtrates from 7 out of 25 tested usually killed rabbits of 1,300–1,600 grams in 1½–2½ hours after intravenous inoculation of 2 to 3 c.c.

Before filtration the cultures were grown in heated blood-broth for 6 to 20 hours. The effects on the animals are uniform. Within half to three-quarters of an hour they show rapid respirations and subsequently the passage of fluid faeces. Gradually the head falls to one side and the animal becomes very prostrate, breathing very rapidly and irregularly, with retraction of the head. A marked leukopenia was noted within one hour after inoculation. At autopsy the lungs were found of a deep pink colour with areas of haemorrhage, most marked in the lower lobes, and oedema. A frothy fluid exuded from the trachea and bronchi, the mucosae of which were intensely congested or actually haemorrhagic. Intestinal contents were fluid and kidneys and liver were congested. In female rabbits the Fallopian tubes were found to be intensely congested. No gross haemorrhages were observed in the nervous system, although histologically the medulla showed small areas of perivascular diapedesis. Under the microscope the lungs were as if injected with blood, the connective tissue septa were oedematous and the alveoli contained red corpuscles or a granular coagulated serous exudate. Control animals injected with broth or with typhoid filtrates did not show similar lesions.

The sera of rabbits inoculated with increasing doses of toxic influenzal filtrates occasionally protected other rabbits against one lethal dose only of homologous or heterologous filtrates, but normal rabbit serum was almost equally potent. The authoress considers that the toxic filtrate cannot contain a true toxin since it is not followed by an incubation period and apparently does not cause the development of a protective serum. As a result of the whole investigation, she points out that although the serological reactions indicated above suggest the parasitic nature of Pfeiffer's bacillus, they are not so striking as to signify that the said bacillus is the specific inciting agent of epidemic influenza. It must, however, be at least a very common secondary invader, and its presence influences the course of the disease. W. B.

**Stevens, F. A.** and **Koser, S. A. Streptolysin production in carbohydrate media.** *J. Exper. M.*, 1919, **30**, 539.

**Nakayama, S. Observations on streptolysin.** *J. Infect. Dis.*, 1919, **25**, 509.

These two papers deal with the same subject from slightly different aspects. Studying only the production of the haemolysin in carbohydrate media Stevens and Koser in a series of experiments, briefly detailed, found that there were several factors which act to affect the production of lysin in such media. The principal factor is the change in the metabolism of the microbe whereby it utilizes more of the carbohydrate and less of the protein in a serum-bouillon-sugar medium. Although the whole growth is better in the sugar medium the production of the lysin is less. The production of acid not only lessens the activity of the streptococcus but is also destructive to the lysin at 37° C. The concentration of the acid produced causes some haemolysis and a brown discoloration of the medium.

Nakayama worked at a wider problem and found that the greatest production of streptolysin occurs in serum-bouillon at 37° C. in 10–24 hours. The lysin traverses filters but loses a certain amount of its activity in so doing. Some experiments are quoted on the relation of virulence to lysin production. A strain of streptococcus passed through 5 rabbits, 15 mice, and 7 guinea-pigs, gave results which indicated that an exaltation of virus was associated with increased production of lysin, which is especially marked for the red corpuscles of the animals of 'passage', although it may have had nearly the same effect on the corpuscles of many different animals before the 'passage' took place. With reference to the toxicity of streptolysin, the author found that when quantities of 3–5 c.c. were injected intravenously rabbits developed diarrhoea and emaciation. That the toxicity of streptococcus filtrates is due to lysin is considered doubtful, as the author found that filtrates may still be toxic after the removal of all lysin by absorption with red corpuscles. W. B.

**Burke, G. S. The occurrence of Bacillus botulinus in nature.** *J. Bact.*, 1919, **4**, 541.

For years after van Ermengem isolated (1896) *Bacillus botulinus* it was looked upon more as a bacteriological curiosity than a matter of importance hygienically. Bacteriologically and serologically the microbe was carefully worked out, but a great deal of doubt existed with reference to its habitat. The occurrence of poisoning by sausages, and the recovery of the microbe from the intestine of a normal pig by Kempner and Pollack, suggested that the alimentary canal of this animal was a probable source of the infection of the sausage meat. It will be remembered that in 1918 there was a considerable scare in this country from the publication in the medical press of numerous alleged cases of botulismus, afterwards shown to be really cases of encephalitis lethargica. Prior to this—indeed from 1915 onwards, E. C. Dickson had made extensive studies on the existence of botulismus in the Western United States, and in 1918 he published his exhaustive monograph on the subject. Dickson examined many samples of the faeces of pigs both grain-fed and garbage-fed, and the soil from two gardens where beans were grown which caused two outbreaks of the disease. His results were entirely negative. The present author working in the Bacteriological Department of the Stanford University, California, claims to have been much more successful. 235 cultures were made from five different localities, the samples including such materials as tap-water, hay, leaves, vegetables, fruits in various conditions, insects, spiders, sow-bugs, snails, caterpillars, garden soil, manure from horses, pigs, and chickens, the claws and beaks, crops, gizzards, and faeces of birds. Seven cultures were obtained from the following sources: (1) bruised and mouldy cherries; (2) bird-pecked cherries; (3) pole-bean leaf covered with droppings of insects or other small animals; (4) spiders from bush-bean plants; (5) bush beans, some of which were slightly scarred, picked over, washed and packed in clean jars for canning; (6) manure from a large hog that had recovered from botulismus; (7) discoloured mouldy hay from an outdoor stack. Four cultures from earth, from spider tube and web, from sow-bug on a bush-bean plant, from linnet's claws, and from a spider and small bugs on bush-beans, gave evidence of weak botulinus toxin. From these observations the author considers that *B. botulinus* is widely distributed in nature, in garden soil, on apparently sound fruit and vegetables, in hog manure, and he suggests that it may be closely associated with spiders or insects common in gardens. It does not appear that actual cultures of *B. botulinus* were obtained, the diagnosis resting on the supposed presence of botulinus toxin which could be neutralized by antitoxin. The samples examined were inoculated into van Ermengem's bouillon under oil, and such cultures were grown at 28° C. for *2–6 months*. Being filtered they were then tested for the presence of botulinus toxin directly or by neutralization with botulinus antitoxin. Consideriug the grossly contaminated nature of the inocula one would have thought that the demonstration of a labile toxin like that of *B. botulinus* at the end of two months would have been no easy matter. The author considers one minimum lethal dose to be 'that amount which will kill a 250 gramme guinea-pig in 48 hours'. It may be pointed out that this is 600 times less toxic than that obtained by Madsen working with a pure culture of *B. botulinus*. W. B.

**Burke, G. S. Notes on Bacillus botulinus.** *J. Bact.*, 1919, **4**, 555.

Leuchs (1910) first showed that there are two strains of *B. botulinus* which differ serologically, viz. that isolated by van Ermengem (1896) at Ellezelles and that of Landmann isolated at Darmstadt (1904). Dickson immunized three goats against his botulinus strains, Nos. III, IV, and VI, and found that III and IV isolated from outbreaks in California and Oregon were homologous, whereas strain VI isolated in Albany, N.Y., from toxic cheese was not neutralized. By means of toxin-antitoxin tests Burke identified 12 strains which fall into two groups designated A and B, of which A corresponds with Dickson's types III and IV, whereas Dickson's type VI corresponds with B. His procedure for obtaining cultures was to inoculate in van Ermengem's salt bouillon or meat, to incubate for three weeks, filter and test the filtrate for toxicity and capability to neutralize antitoxin. The bouillon cultures which showed toxicity were subcultured as agar shakes, the colonies being later 'fished' out. He describes the deep agar colonies of *B. botulinus* as very characteristic. When young they appear as a thin translucent disk 'having a small knot or "nucleus" on or near the periphery on one side. The edge of the disk is either flattened or sharply indented at the point nearest the knot. The disk is more or less completely filled with clear spots or "vacuoles" which are in reality gas bubbles caught in the meshes of the bacterial growth. The outline of the colony is always clear cut and definite'. Very few details are given of growths or fermentation reactions on other media. Equally potent toxins were produced at 37·5° C. and 28° C. W. B.

**Christiansen, M.** Hvalseptikæmiebacillen og dens Forhold til Ødembacilgruppen. [**Whale septicaemia bacillus and its relation to the group of oedema bacilli.**] *Norsk Mag. f. Lægevidensk.*, 1919, **80**, 993.

This is an interesting study of anaerobic bacteria isolated from whales in the following remarkable manner. For centuries the Norwegians used to catch whales (*Balaenoptera rostrata*) by infecting them with pathogenic bacteria carried on poisoned arrows. Armauer Hansen, and others, showed in the eighties that death was due to a microbe resembling *B. chauvoei.* Some of the infected muscle had been preserved in the Veterinary School in Copenhagen *for 30 years,* and was the material of examination in the present research, the author having succeeded in obtaining a pure culture which turned out to belong to the *Vibrion septique* group, as shown by its fermentation reactions and pathogenic effects. It is to be noted that the author expressly states that active motility was never observed with certainty. Otherwise his microphotographs are characteristic of *Vibrion septique.* The production of acid and gas in glucose and other hexoses, maltose, lactose, and salicin, and the absence of fermentation in sucrose, raffinose, dulcitol, mannitol, glycerol, and inulin confirm this opinion as also the absence of peptonization of the clot produced in milk. The pathogenic effects described are those of *Vibrion septique,* to which is added a new observation namely that the microbe was found experimentally to be pathogenic for the porpoise (*Phocaena communis*). The author made a serological comparison between the whale bacillus, a braxy strain, B. of Ghon and Sachs (obtained from Král) and 3 strains isolated from carcases. Apparently the whale bacillus had a very slight power to elicit agglutinins compared with the other microbes. On the other hand in complement fixation or passive immunization experiments it did not differ materially from the others. This agrees with the statement of the Anaerobic Committee report recently published (*Medical Research Committee, Special Report Series,* No. 39, 1919, p. 53) that with reference to the agglutination reactions of *Vibrion septique* there 'are at least three serological types which, while producing different agglutinins, are found to be a single group as regards their toxin-antitoxin reactions'. W. B.

**Ford, W. W.** and **Williams, G. H. Observations on the production of an anti-haemotoxin for the haemotoxin of Bacterium welchii (Bacillus aerogenes capsulatus).** *J. Immunol.*, 1919, **4**, 385.

The authors have studied the haemolytic properties of filtrates from cultures of *B. welchii.* They show that the lysis of blood is due to a true toxin and not to substances like butyric acid, as some have asserted, since the filtrates retain their haemolytic properties after complete neutralization of any acid which may have been formed. Further, the haemolytic substance is thermolabile and antigenic.

The haemotoxin was obtained in massive milk cultures grown for 24–48 hours. The cultures were filtered through coarse paper—a slow process lasting 18–24 hours—and neutralized. A gelatinous precipitate, occurring after neutralization, was removed by filter paper or a Berkfeld candle. From a litre of milk about 400 c.c. of a clear straw-coloured haemolytic filtrate could usually be obtained of such a strength that 0·025 c.c. laked 1 c.c. of a 5 per cent. suspension of rabbits' erythrocytes in 4 hours at 37° C. The toxin was relatively stable during months if kept in the dark.

Injection of such a toxin in rabbits produced, at most, but trivial effects. Four months after repeated doses it was found that the sera were markedly anti-haemolytic. In a series of experiments quoted, the authors found that rabbits' corpuscles *in vitro* were completely protected against 0·1 c.c. of the haemolysin by 0·0008 c.c. (about 1:1250) of the anti-haemolytic serum. Normal rabbit serum has slight protective properties but only in dilutions not greater than 1:10. The union of the lysin-antilysin was found to follow the law of multiple proportions. W. B.

**Christiansen, M.** Bacillus phlegmones emphysematosae (Frænkel), Welch-Frænkels Bacil og dens Forekomst ved den spontane Forraadnelse. [**Bacillus phlegmones emphysematosae and its occurrence in spontaneous putrefaction.**] *Meddelelser fra den Kgl. Vet. og Landbohøjskoles Serumlab. Kjøbenh.*, 1919, **59.**

This is a study of the incidence of *B. welchii* in the organs and heart-blood of carcases of 28 horses, 12 cows, 2 sheep, 1 stag, 3 pigs, 14 dogs, and 3 hares. The microbe was found in more than 40 per cent. of the cadavera examined. Sometimes it was present in large quantities either in apparently pure culture or in association with other bacteria. Twenty-two strains were isolated, and, together with one from a gas gangrene case in man, were submitted to a thorough investigation. All the strains fermented dextrose, mannose, galactose, fructose, trehalose, maltose, lactose, saccharose, raffinose, glycerine, and glycogen, whereas none fermented arabinose, xylose, rhamnose, dulcitol, adonitol, or mannitol. Ten of the strains fermented sorbitol, whereas twelve and the human strain were unable to do so. The action or want of action on sorbitol seemed to be constant. By subcutaneous or intramuscular inoculation the cultures were very pathogenic for guinea-pigs, pigeons, and sparrows, but far less for rabbits, rats, and mice. Cultures rapidly became attenuated, especially in carbohydrate media, but the virulence could be restored by a series of quick transfers on the brain medium of v. Hibler. Filtrates from the oedema fluid or from old broth cultures to which chalk had been added proved lethal for guinea-pigs in doses of 0·3 c.c., the lesions produced being similar, in the main, to those caused by living cultures. Rabbits and horses were immunized over a long period with cultures, but the sera had only feeble agglutinating properties and then only on the homologous strains. Passive immunization experiments on sparrows and guinea-pigs showed that the sera were not effective even against homologous strains. A peculiar effect of normal sera was, however, observed. Serum from normal horses, even in small quantities, had a marked anti-infective action when mixed with culture. In experiments on sparrows 0·004 c.c. normal horse serum nullified the effect of a lethal dose of culture. It also neutralized toxic filtrates of cultures of *B. welchii*. The same was the case with normal cattle or goat sera, while normal rabbit or guinea-pig serum was only slightly effective. W. B.

**Wilson, W. James. An analysis of seventy-six cases of gas gangrene occurring at a base hospital, with remarks on the results of serum treatment.** *J. Roy. Army Med. Corps*, 1919, **33**, 455.

The author states that his analysis is based on his experience at a base hospital. He therefore deals with patients who had in the majority of instances received previous treatment at a casualty clearing station. Thus no fulminating cases were observed. With regard to the date of onset after injury, he says that, if a wounded man shows no signs of gas gangrene after three or four days little apprehension need be felt in regard to the onset of this complication. The old surgical attitude towards the onset of laudable pus is evidently explicable on the fact that once suppuration has developed the invasive powers of anaerobic bacteria appear to be checked. It is only in those cases where there is a thin watery discharge that any danger may be feared.

Where gas gangrene develops late it is usual to find that the wound had not been sufficiently opened up and that all foreign bodies had not been removed. In 42 of the 76 cases investigated definite symptoms of gas gangrene appeared within 48 hours of the receipt of the wound. In approximately 55 per cent. of the cases the incubation period was less than 48 hours, and in about 15 per cent. it was more than 48 hours but less than 72 hours. When the complication developed at this later period it was usual to find that there was some obstruction to the blood supply of the wounded tissues. In about a third of the cases there was a history of secondary haemorrhage with ligature of vessels.

A complete bacteriological analysis was made of the cases. *B. welchii* was the predominating organism, although the author states that if other methods had been employed he might have been more successful in isolating other pathogenic anaerobes such as *Vibrion septique* and *B. oedematiens*. The bacilli met with in the 76 cases were as follows: *B. welchii*, 74; *B. sporogenes*, 41; *B. tetani*, 24; *B. tertius*, 13; *Vibrion septique*, 2; *B. oedematiens*, ? 2; *B. tumefaciens*, 1; *B. fallax*, ? 1.

With regard to the curative effects of serum, the writer states that in his experience its effects were of doubtful benefit, but that if larger doses had been given, and the serum injected into the affected parts better results might have been obtained. The numbers dealt with in the various groups, however, are too small to allow much reliance to be placed on the results.

J. McI.

**Von Eisler, M.** u. **Silberstein, F.** Ein Beitrag zur Gewinnung von Tetanusserum. [**A contribution to the production of antitetanic serum.**] *Ztschr. f. Hyg. u. Infektionskrankh.*, 1919, **89**, 29.

This paper contains the protocols relative to the immunization of a number of horses against tetanus for the production of antitetanic serum. With usual methods the mortality during the immunization process may be high when, as in war time, the animals may have to be rapidly inoculated. By the addition of formalin to the tetanus toxin a relatively non-toxic but antigenic mixture is obtained. Tetanus bouillon is filtered through paper and to it is added formalin (40 per cent. formaldehyde) to the amount of 1·5 per cent. The mixture is placed in the incubator at 36° C. for about 5 weeks till guinea-pigs can tolerate doses of 3 to 4 c.c., whereas the original toxin killed mice in quantities of 0·0001 c.c. As much as 200 c.c. of the formalin toxin was the first dose administered to the horse. No animals were lost during the subsequent injections of tetanus toxin alone. W. B.

**Altstaedt, E.** Immunbiologische Untersuchungen über Tuberkulosedisposition und Immunisierungsmechanismus. [**Investigations into the nature of tuberculous disposition and the mechanism of immunization.**] *Beitr. z. Klin. d. Tuberk.*, 1919, **42**, 94–6.

**Brecke, A.** Beobachtungen über Partialantigene. [**Observations on partial antigens.**] *Ztschr. f. Tuberk.*, 1919, **30**, 270–7.

**Liebe, G.** Partialbehandlung nach Deycke-Much. [**Partial antigen treatment. (Deycke-Much).**] *Ztschr. f. Tuberk.*, 1919, **31**, 76–84.

**Müller, W.** (1). Klinische und immunbiologische Untersuchungen mit den wasserlöslichen Bestandteilen der Tuberkelbazillen. [**Clinical and immunological investigations with the water-soluble component of the tubercle bacillus.**] *Wien. klin. Wchnschr.*, 1919, **32**, 659–61.

**Müller, W.** (2). Immunbiologische Untersuchungen über Tuberkulosedisposition und Immunisierungsmechanismus. [**Investigations into the nature of tuberculous disposition and the mechanism of immunization.**] *Beitr. z. Klin. d. Tuberk.*, 1919, **42**, 87–93.

**Rehder, H.** Eineinhalb Jahre klinischer Beobachtungen über die Behandlung der Lungentuberkulose mit Partialantigenen nach Deycke und Much. [**Clinical observations over a year and a half on the treatment of pulmonary tuberculosis with partial antigens (Deycke-Much.)**] *Beitr. z. Klin. d. Tuberk.*, 1919, **42**, 283–99.

**Schulz, E.** Einige Bemerkungen zur Behandlungsart mit den Deycke-Muchschen Partialantigenen. [**Some observations on the mode of treatment with the partial antigens of Deycke and Much.**] *Inter. Centralbl. f. d. ges. Tuberk.-Forsch.*, 1919, **13**, 90–3.

If the space occupied by a subject in German medical literature were any criterion of its importance, the partial antigens of the tubercle bacillus separated by the Deycke-Much method would claim considerable priority. During the last five years a steady stream of publications has added more controversy than elucidation to the attempt to find a rational basis for the specific treatment of tuberculosis, and the papers here quoted represent only a few of the more recent clinical communications on the subject, and do no more than point the way to the complete literature.

Though the original experimental work was not entirely convincing, the claim was made that antibodies were produced against three separate components of the water-insoluble residue (M.Tb.R.) of tubercle bacilli treated with weak organic acids. These components were a protein fraction (A), a fatty acid-lipoid fraction (F) and a neutral fat-fatty alcohol fraction (N). This finding was made the basis of an immunity analysis by intracutaneous inoculation of varying dilutions of the separate antigens, and the results were expressed graphically on a simple scheme of squares, showing the partial-reactivity of a patient at the time of the test.

On the ground of such analysis, treatment was instituted by the injection of those partial antigens to which a response was lacking in the analysis, since it was believed that only by means of the sum of the necessary partial antibodies could an infection be overcome. In this scheme the water-soluble fraction (L) or 'pure tuberculin' was rejected on the ground that it was toxic and interfered with the development of the desired antibacterial immunity. This was the cause of a gulf between the Deycke-Much school and the tuberculin supporters, which Müller has recently tried to bridge by a theoretical and practical defence of the L fraction.

The scheme at least promised a degree of mathematical accuracy which was entirely attractive after the vaguer empiricism of the numerous tuberculin preparations, and immune analysis was extensively applied to tuberculous subjects of all kinds and undergoing many different kinds of treatment. In healthy subjects partial reactivity was found to maintain a fair constancy over short periods. It was found like tuberculin to be no absolute guide to the activity of tuberculous disease, but to a considerable extent increase or decrease of reactivity moved parallel with the clinical condition. Müller showed that various methods of treatment of tuberculosis were associated, when successful, with a rise in partial reactivity, and it was interesting to find that of the tuberculins T.R. (the nearest in composition to M.Tb.R.) had the most marked effect. Altstaedt carried the matter further by applying the analysis to the question of familial infection and prophylaxis.

But while the general principle could be maintained that no healing occurred without an improved immunity titre, many awkward observations showed that the matter was more complex than had at first sight appeared. The complete absence of partial reactivity in some healthy subjects, and the rapid decline of advanced cases in spite of a high titre, called forth new theories with varying degrees of foundation. The distinction between cell-immunity (as investigated by the intracutaneous analysis) and blood or humoral immunity is emphasized by one school of thought. Müller distinguished dynamic from static immunity, and emphasized the necessity to health of a capacity for developing what he calls 'positive dynamic immunity'. The general trend has been to pay less attention to middle values for the various partial antigens in the immunity analysis, and to concentrate on the significance of consecutive changes in the immunity picture, and on the intensity of the various reactions. From these different standpoints a lively controversy has arisen between Altstaedt and Müller, which it is impossible to follow here in detail. As between various groups of tuberculous cases there seems to be some definite differences in partial reactivity, including a more pronounced relative F and N reactivity in skin and surgical tuberculosis, though in some circles doubt has been thrown on the specificity of the F and N partials. Müller upholds an A predominance in pulmonary tu erculosis which is vigorously contested by the Deycke school.

It is as yet impossible to decide on the final value of the method. Anything is welcome which tends to a more specific analysis of the nature of immunity phenomena in tuberculosis, but the facts adduced at present hardly seem constant enough to warrant the final acceptance of the Deycke-Much components of the tubercle bacillus as significant and homologous antigens.

To turn however to practical results, reported recently, of treatment with partial antigens, the literature largely confirms the positive results reported during the war. Rehder emphasizes the fact that it is not suitable for ambulant treatment in active tuberculosis, but has given good results in cases of pulmonary tuberculosis not too far advanced and not complicated by intestinal or laryngeal disease. The risk of harmful focal or general reaction is not entirely absent as was at first thought, but it does not appear to be great, and is to be distinguished from the risk of accidents resulting from technical lapses in making strictly intracutaneous tests. Brecke reports good results, especially in non-pulmonary tuberculosis of limited distribution, confirming previous work of Deycke and Altstaedt. His clinical results and analyses were not conspicuous by their correspondence. The composite M. Tb. R. was used for the most part in place of the separate antigens, a procedure which is officially approved as labour saving, and is even found by Müller to present certain advantages in increasing F and N reactivity.

Of 134 cases of pulmonary tuberculosis reported by Liebe, 50 per cent. showed correspondence of clinical course and analysis. A majority showed greater increase of F or N reactivity than of A reactivity during the course of treatment.

Schulz pleads for diminishing dosage in contrast to the method of increasing dosage usually employed. In this way successive injection periods start (as originally recommended for initial treatment) at doses below the contemporary immunity level. He raises the question of the proper procedure where an antibody or antibodies fail entirely. Warnings have been uttered against injection of partial antigens in this case, as liable to lead to untoward results. The alternatives seem to be to start with the smallest doses, or to wait until the antibodies appear under general treatment. Schulz practised the former method. In all the current literature the tendency is towards smaller dosage except in heroic attempts to improve desperate cases.

The general results are certainly less conflicting and somewhat more uniformly favourable than in previous attempts at the specific treatment of tuberculosis, but no final judgement can be presented either on the theory or the practice of the Deycke-Much system until more confirmatory work has been done. C. D. W.

**Bloomfield, A. L. The fate of bacteria introduced into the upper air passages.** *Am. Rev. Tuberc.*, 1919, **3**, 553–67.

Bloomfield reports on the fate of micro-organisms artificially implanted on the upper respiratory tract in man. As a preliminary study a non-pathogenic micro-organism was sought which could be easily grown and recognized in smear or culture, but which was not normally present in the upper air passages, and not easily overgrown by the normal mouth flora. A strain of *Sarcina lutea* was finally selected, and subjects were chosen who showed no gross abnormality of the upper respiratory tract. Solid masses of growth were swabbed on the selected site, after which a platinum loopful of mucus was taken at intervals, rubbed up in saline, and spread over agar plates in varying dilutions.

Even after a short time it was found impossible to recover sarcina swabbed in large amounts on the tongue and nasal mucosa, or into the crypts of the tonsil. After about an hour growths could no longer be obtained, except from the nose, where disappearance is slightly slower. Estimated doses of 50–100 billion organisms were dealt with in these short periods, and this naturally led to analysis of the factors involved. These may be classified as mechanical (flushing of the mouth, with ejection or swallowing of the secretion): chemical (reaction of secretion, &c.); and biological (phagocytosis and the effect of other organisms). But the most extensive artificial irrigation of the mouth only reduced the count by 50 per cent., and experiments *in vitro* reproducing oral conditions failed to show any effect exerted by the normal mouth flora. Turning therefore to the mouth secretions, it was hardly possible for the reaction itself to have much effect on sarcina, which grows equally well on artificial media adjusted anywhere between $P_H$ 5 to 8. But it was found that saliva exerts a marked and rapid bactericidal effect, and this was undoubtedly the significant factor in the rapid disappearance of the micro-organism. C. D. W.

**CORPER, H. J. The cultivation of recently isolated and laboratory strains of human tubercle bacilli on artificial media.** *Am. Rev. Tuberc.*, 1919, **3**, 461.

Corper reports extensive cultivation experiments on the human tubercle bacillus. The constituents of his basic medium were agar, ammonium phosphate and salt. On this nothing grew. The first addition was glycerol, which produced a few slight growths. The subsequent media of the series were made by additions of beef extract, peptone, egg, milk, blood, tissues, &c.

The bacilli were isolated from sputum on Petroff's medium, and two types of culture were investigated, namely those recently isolated and those recultivated for long periods on egg or glycerol agar. The author notes a distinct difference between these two groups. Bacilli artificially cultivated for about a year grow well on a medium made of the basic constituents and glycerol *plus* any of the following: beef extract and peptone, egg, defibrinated rabbit's blood, or ground-up testes, liver or brain. Recently isolated bacilli grow more sparsely, and only on a few of the media, especially those containing egg and rabbit's blood. A few strains failed on all media.

C. D. W.

**MILLER, W. S. The vascular supply of the lymphoid tissue in the rabbit's lung.** *Am. Rev. Tuberc.*, 1919, **3**, 449.

**WILLIS, H. S. The origin and relationships of the bronchial artery in the guinea-pig.** *Am. Rev. Tuberc.*, 1919, **3**, 453.

Miller and Willis publish further anatomical studies on the lung, which are of considerable importance to those who have occasion to use the rabbit and guinea-pig as experimental animals. In the rabbit Miller shows that it is the pulmonary artery, not the bronchial, which furnishes the vascular supply of the lymphoid tissue in the lung. Hence micro-organisms introduced into the venous circulation of the rabbit are conveyed directly to the pulmonary lymphoid tissue by the pulmonary artery.

In the guinea-pig Willis finds that the bronchial artery arises neither from the dorsal aorta nor from the intercostals, but from a vessel which has its origin in the right subclavian. Again, while in man and the dog some uncertainty still prevails as to whether there be any communication (apart from capillary communication) between the pulmonary and bronchial systems, in the guinea-pig it now appears that definite anastomoses exist beyond doubt. Branches of the bronchial artery are found to form the vasa vasorum of the pulmonary system, and it is the bronchial artery which supplies the lymphoid tissue situated within the lung. These conclusions were reached by cutting serial lung sections after injection of the vessels either with Indian ink, or with mercuric sulphide in 20 per cent. gelatin, a suspension which has granules too large to pass freely through the capillaries. Excellent plates accompany the papers.

It appears quite clearly that the greatest caution must be used in drawing analogies between different types of laboratory animals, and that each type must be separately studied from an anatomical point of view before pathological comparisons can be justified. C. D. W.

**Seligmann, E.** u. **Klopstock, F. Zur Biologie der Fischtuberkelbazillen.** *Beitr. z. Klin. d. Tuberk.*, 1919, **42**, 45.

Seligmann and Klopstock have re-examined the original strain of fish tubercle bacilli isolated by Dubard in 1897. For the last 10 years it has been recultivated at Berlin without animal passage, and it preserves its main characteristics. No growth occurs at 37° C., the optimum lies between 25° C. and 30° C.; fair growth occurs at room temperature, and some cultures even in the ice-chest. The strain shows a great tendency to relapse into beading, clubbing, and branching in old culture. A fresh culture covers a glycerine-agar tube in a week.

On injection into the dorsal lymph-sac of the frog, the bacilli multiply freely in the organs, but only occasional lesions occur, in the form of necrotic conglomerate nodules in the liver, which contain countless bacilli, but show none of the characteristics of histological tubercle. The frogs showed no reaction to a fish-tuberculin. Mammalian tubercle bacilli showed no increase in the tissues of the frog, nor any harmful effect.

Injection of fish tubercle bacilli into guinea-pigs often caused rapid wasting and death, but apart from occasional nodules in the liver and peritoneum (in the latter of which bacilli were found) no apparently specific pathological changes occurred. The animals showed no reaction to fish-tuberculin.

Immunization experiments on guinea-pigs were conducted, but no protective effect against a subsequent dose of human bacilli was observed. The authors had the impression that the onset of disease was delayed, but the human strain was not very virulent, and the contention is not supported by control evidence. Fish tubercle bacilli are entirely innocuous to rabbits.

C. D. W.

**YOUNG, H. C.** and **GIVLER, J. P.** **A comparison of certain antigens used in complement fixation tests in pulmonary tuberculosis.** *Am. Rev. Tuberc.*, 1919, **3**, 476–82.

Young and Givler report the result of complement fixation tests for tuberculosis, in which three antigens were compared, namely the methyl alcohol antigen of Petroff, the autolysate antigen of Corper, and Wilson's antigen. In percentage positive findings in known cases of pulmonary tuberculosis the antigens did not greatly differ, the highest figure being 66 per cent. for Petroff, while clinically normal persons showed about 11 per cent. of positives. This is of course a percentage efficiency which hardly warrants extensive clinical use of the test, and the authors rightly plead for less empiricism and more definite scientific basis for the introduction of new antigens.

Fifty to sixty per cent. of positive luetic sera gave cross-fixation with the tuberculosis antigens. Of the technical points emphasized, the standard Noguchi human haemolytic system was preferred to the sheep system, and guinea-pigs with serum unsuitable for complement fixation tests turned out to be one in every seven. C. D. W.

**DOERR, R.** u. **PICK, R.** Das Verhalten des Fleckfiebervirus im Organismus des Kaninchens. [**The behaviour of typhus virus in the body of the rabbit.**] *Ztschr. f. Hyg. u. Infektionskrankh.*, 1919, **89**, 243.

Whereas the experimental disease produced in guinea-pigs by inoculation of material from typhus fever is well understood, the question of the susceptibility of the rabbit is still a matter of doubt, the majority of investigators having obtained only negative results. Doerr and Pick, who have already made very important communications on the subject of guinea-pig typhus, extend their researches to the rabbit in the present communication. Using virulent cerebral tissue from 'passage' guinea-pigs they find that inoculated rabbits show no characteristic rise in temperature whether the inoculation is subcutaneous, intraperitoneal, intravenous, or intracerebral, and even although massive doses of virulent tissue are used as the inoculum. Experiments with normal guinea-pig brains are also negative as is inoculation of guinea-pigs with normal rabbit brains. Although the rabbit inoculated with virulent typhus passage virus produces no visible rise in temperature, the authors found in certain cases, at any rate, indubitable evidence of a localization of the virus in the rabbit's brain, even when the inoculation was extracerebral. The characteristic vascular lesions of typhus guinea-pigs (vide *Med. Science,* 1920, **1**, 447) were not found in rabbits although the brains of the latter were capable of transmitting a latent infection to other rabbits. Although no definite symptoms or lesions occur in the rabbit, the cerebral tissue in the second rabbit passage contains the virus unaltered for guinea-pigs, developing in them the typical disease with the same incubation period as that induced by the direct inoculation of the louse typhus virus. Many rabbits inoculated with typhus virus reveal agglutinating properties for *Proteus X* 19 and *B. typhosus* in dilutions up to 1 : 60 and 1 : 40 respectively. The authors regard this agglutination as quite unspecific. No *Proteus X* 19 was recoverable from typhus rabbits. W. B.

**Gins, H. A.** Über Beziehungen zwischen Tier- und Menschenpocken. [**On the relation of human to animal pox.**] *Ztschr. f. Hyg. u. Infektionskrankh.*, 1919, **89**, 231.

In this investigation the author confirms the old view that among domestic animals, sheep, goats, and pigs there is a definite form of pox associated with a characteristic exanthem of a variolous type. By experiments he shows that the lesions can prove infective in rabbits, and in a few passages through this animal typical vaccinia is induced in the calf, and from it children can be successfully inoculated and develop typical Jennerian pocks. The source of the material was from epizootics, in Berlin, of pig pox and goat pox. The sheep pox material was obtained from Bulgaria. Experiments are also detailed showing that variolous matter taken directly from a human case produced lapine which in the fourth passage in rabbits was successfully inoculated into calves and from them into children. The effect in the child was typical vaccinia the variola having been transformed by passage through the rodent and calf. W. B.

**van Riemsdyk. M.** Der Micrococcus tetragenus albus als Erreger einer Meningitis Cerebrospinalis. [**Micrococcus tetragenus albus as a cause of a cerebrospinal meningitis.**] *Ztschr. f. Hyg. u. Infektionskrankh.*, 1919, **89**, 146.

An exact account of the biological and morphological characters of *Micrococcus tetragenus albus* which was found during life and after death in a child suffering from cerebrospinal meningitis. The very scattered literature on this microbe is collected and analyzed. W. B.

**Sanarelli, G.** De la pathogénie du choléra (premier mémoire). La défense naturelle du péritoine contre les vibrions. [**The pathogenesis of cholera. The natural peritoneal defence against cholera vibrios.**] *Ann. de l'Inst. Pasteur*, 1919, **33**, 837.

This in substance has been reviewed (*Med. Science*, 1919, **1**, 3) when the author's other communications on the same subject were considered. The present memoir is illustrated by three coloured plates. W. B.

**Marie, A. (de Villejuif), Levaditi, C.** et **Banu, G.** (1). Nouveaux essais de transmission du tréponème de la paralysie générale au lapin. [**New attempts to transmit the treponema of general paralysis to the rabbit.**] *Compt. rend. Acad. d. sc.*, 1919, **169**, 742.

**Levaditi, C.** et **Marie, A. (de Villejuif)** (2). Étude sur le tréponème de la paralysie générale. [**Study of the treponema of general paralysis.**] *Ann. de l'Inst. Pasteur*, 1919, **33**, 741.

These two communications are on the same subject, the first brief, the second detailed. From a typical case of general paralysis of the insane the authors withdrew blood by venepuncture and injected it partly into the scrotum, partly into the testicle of a rabbit, which after an inoculation period of 127 days manifested confluent papules, on the scrotum, laden with spirochaetes. The blood of five other cases of G.P.I., of one case of tabes, and of one case of mania of suspected syphilitic origin was injected into rabbits with negative result. Two days after the appearance of the positive result above mentioned a small piece of the scrotal lesion was excised and inoculated into a series of five rabbits, all of which developed scrotal lesions after incubation periods varying between 55 and 94 days. The first passage was succeeded by a second with an average incubation of 55 days, and by a third passage in which the average incubation was 41 days. Circumstances prevented the experiment from being carried farther. The authors comment on the fact that in all successful inoculations, apart from the long incubation period, the lesions were trivial compared with those resulting from the inoculation of ordinary syphilitic material. They correlate this with the well-known observation in man that general paralysis of the insane very frequently follows in the wake of an attack of syphilis which at first was trivial and may indeed have been overlooked. As Fournier expressed it, ‘ la syphilis débute et évolue, chez les futurs paralytiques généraux et tabétiques, d’une façon plutôt bénigne ’.

The authors state further, on the authority of Plaut, that general paralysis first became common only after the end of the seventeenth century, and they suggest that in the long course of years a special variety of spirochaete may have been evolved with marked neurotropic tendencies. They suggest that the existence of conjugal and familial nervous syphilis supports their contention, and they consider that there are two distinct varieties of *S. pallidum*, the one—dermotropic—obtained from ordinary cases of syphilis, the other—neurotropic—which they obtained from a case of G. P. I. as detailed above. They have made a comparison of the effects of these two viruses. The ‘ virus dermotrope ’ was obtained by Truffi in 1908 by inoculating into the testicle of the rabbit the juice of a chancre 40 days old. This virus of Truffi has been passed through rabbits for years, and has been very minutely studied.

When the two viruses are compared after inoculation in rabbits, it is found that the incubation period of the neurotropic variety is much longer, although this may be in part attributable to the smaller number of spirochaetes in the inoculum.

The lesions caused by the neurotropic virus are essentially superficial in the form of slight erosions and are never like the coarse indurated chancre resulting from the inoculation of the dermotropic type. Microscopically the neurotropic lesion in the scrotum is a thickening of the superficial parts of the dermis and especially of the epidermis, with little endarteritis, but intense perivascular infiltration. With the dermotropic virus the lesion is much deeper with marked endarteritis. A table showing the principal points of differentiation is given :

| *Neurotropic virus.* | *Dermotropic virus.* |
|---|---|
| Macroscopically. | |
| Papulo-squamous erosion | hard chancre |
| Microscopically. | |
| Epidermis, erosion, desquamation ; slight ulceration | deep ulceration |
| Dermis, periarteritis ; no endarteritis | endo- and periarteritis |
| Infiltration ; slight | intense |
| New formation of connective tissue ; absent | intense |
| Spirochaetes : epithelial layer | deep tissues |

These differences were also observed in monkeys (macaques and chimpanzee).

After its prolonged sojourn in the bodies of rabbits during passage it was found that the dermotropic virus is markedly pathogenic for monkeys, producing severe lesions. An accidental infection on the back of the hand of an assistant showed that the virus Truffi causes syphilis in man, although in this instance the infection was not severe. The statement of Krafft-Ebing (1897) that syphilis cannot be transmitted to general paralytics was confirmed by the present authors, for on inoculating the active dermotropic passage virus into two typical cases of G. P. I. nothing transpired.

With the neurotropic virus no effect was observed in macaques (2) or in the chimpanzee or in man, after inoculation from the first rabbit passage.

It is known that rabbits which recover from experimental syphilis are refractory to a second inoculation. The authors now bring forward experimental evidence in detail, to show that rabbits which recover from inoculations of the dermotropic or neurotropic virus are refractory to a second inoculation of the homologous, but are susceptible to the heterologous virus; and they conclude from these experiments that the differentiation of the two varieties of spirochaetes in general paralysis on the one hand, and in cutaneous and visceral syphilis on the other, is justifiable, although they do not ignore the difficulties of the problem or the lacunae in their work.

W. B.

**Boughton, T. H. Studies in protein intoxication. IV. Histologic lesions produced by injections of peptone.** *J. Immunol.*, 1914, **4**. 381.

The author describes briefly the pathological lesions in guinea-pigs, following the intraperitoneal injection of Witte's peptone in repeated doses from 0·6 to 2·0 grammes per kilo. The average number of doses given was five and the maximum eight. Death usually occurred several hours after the last injection. The symptoms consisted in ruffling of the hair of the head and neck, respiratory distress with hiccough, and prostration. Most commonly, if an animal does not die after the first injection, a subsequent injection of the same dose is without effect, but a larger dose will bring on the above symptoms. The autopsy shows the lungs to be fully expanded and the organs are all congested. Histologically, lesions of the liver and kidney consist of degeneration and necrosis of epithelium followed by regeneration. Other changes were oedema of the walls of the smaller arteries with endothelial proliferation. In the heart the only, but almost constant, change was a round-cell infiltration (in a site not stated). The macro- and microscopic appearances showed a striking similarity to those found in guinea-pigs rendered anaphylactic. W. B.

**Gottlieb, Mark. Experimental purpura.** *J. Immunol.*, 1919, **4**, 309.

The author confirms the fact that injection of blood-platelets produces an anti-platelet serum which dissolves platelets and red blood corpuscles *in vitro* and may produce haemorrhages in the intestine, stomach, liver and heart. An anti-platelet serum developed in a rabbit did not produce an 'anti' effect when injected into another rabbit. No mention is made of the pioneer work of Ledingham (1914) except in the bibliography where his name occurs twice in a total of four references. W. B.

**Sands, J. E.** and **West, L. B.** **Experiments on the removal of haemagglutinin from rabbit anti-human serum.** *J. Immunol.*, 1919, **4**, 275.

One of the drawbacks to the use of an anti-human haemolytic system in Wassermann tests is the occurrence of haemagglutination which may interfere with the haemolysis. The present paper deals with the question whether this disturbing factor can be lessened or removed without detriment to the haemolytic content of the serum. The authors found that dessication of the serum on a filter paper by Noguchi's method, or in evaporating dishes, leads to distinct destruction of the agglutinin but is without effect on the lysin. Filtration of immune serum, especially when diluted (1 : 10), through Kitasato or Chamberland bougies removes a large amount of haemagglutinin, while it leaves the haemolysin intact or nearly so. Absorption of rabbit anti-human serum by means of barium sulphate removes large amounts of agglutinin, while the action on the lysin was found to be irregular. Absorption of anti-human serum with large quantities of washed human erythrocytes removes agglutinin more than lysin. Solutions of pure sodium chloride in final dilutions of 1·5 per cent. and higher tend to prevent haemagglutination: dilutions of 1·7 or 2 per cent and higher tend however to interfere with haemolysis. W. B.

**Kyutoku, T.** **A study of the thermolabile and thermostable antilysins (anti-complementary substances) of human serum.** *J. Immunol.*, 1919, **4**. 239.

In connexion with complement-fixation tests it is well known that certain sera contain substances which are capable of interfering with haemolysis. The nature of these so called 'anti-complementary' substances is the subject of an inquiry by Kyutoku, who carried out his research in the Laboratory of Experimental Pathology, University of Pennsylvania. The main conclusions which he reached are that in human sera anti-complementary substances (antilysins) are of two kinds, one thermolabile and destroyed at 56° C., the other thermostable. Human sera do not develop antilysins as a result of heating, as may occur with the sera of rabbits, dogs or mules. Sterile sera at 37° C. may develop thermolabile antilysins in from 3 to 7 days, while at room temperature or at zero longer periods are required. Fresh sera rapidly dried on Schleich and Schull's filter paper No. 597 and kept in stoppered bottles at room temperature do not develop antilytic effects even up to 20 days. Sera containing various bacteria such as *B. coli*, *B. typhosus*, *B. subtilis*, but especially *Staphylococcus albus*, rapidly develop anti-complementary effects of both thermolabile and thermostable characters. The cocci themselves rather than their products seem to be responsible for these effects.

Since the sera of old specimens of blood, collected under ordinary conditions or deeply tinged with blood and infected with bacteria, are often anti-complementary, experiments were made to determine whether disintegration of red blood corpuscles alone may contribute the antilytic substances. Large amounts of haemoglobin in salt solution and serum, sterile and contaminated. were found to be anti-complementary both before and after heating. Traces of haemoglobin were free from these effects. The author noted that sterile and contaminated sera containing antilytic substances gradually become alkaline in reaction: neutralization of the alkali by hydrochloric acid did not remove the antilysins. Definite changes in the hydrogen-ion concentration of sterile and contaminated human sera before and after the development of antilysins could not be proved on using Bronfenbrenner's china-blue-roseolic acid indicator. The investigations of Zinsser and Johnson, and of Kolmer indicate that the antilytic substances are, in part at least, associated with the globulin fraction of the serum. The author's experiments indicate that contaminated sera which are antilytic show a marked increase of total protein, especially of the albumin fraction. Sera strongly anti-complementary before or after heating, and filtered through Kitasato filters, which removed both thermolabile and thermostable antilysins, showed a decrease in total proteins and especially of the globulin fraction. Removal of ether soluble lipoids from anti-complementary human sera did not remove the anti-complementary substances, absorption of human sera by barium sulphate and to lesser extent kaolin, silicon, bone ash, or charcoal tends to remove a certain proportion of the antilysins. Washed red blood corpuscles had no such effect in the case of human sera at any rate. Filtration of diluted (1:10) human sera through new, clean, sterile Kitasato filters removes all antilysins. Filtration of syphilitic sera has practically no influence on the Wassermann-reacting body. Of further interest were the results of experiments with emulsions of *Staphylococcus aureus*, filtration of which removes antilytic substances wholly or partially. Alcoholic cholesterin heart extracts as used in Wassermann tests show no reduction in antilytic titres after filtration, although the antigenic properties are entirely removed. W. B.

**Fennel, E. A.** and **Fisher, M. B. Adjustment of reaction of culture mediums.** *J. Infect. Dis.*, 1919, **25**, 444.

The authors were engaged in preparing large quantities of pneumococci in a serum-free broth. They titrated at the boiling point to + 0·2 (0·2 per cent. acid) to phenolphthalein, and found the usual difficulty in the accurate determination of the neutral point. Consequently different batches gave very different results in the growths of the pneumococci. This led them to try the hydrogen-ion concentration method, which was found to be quite simple and practical. The optimum reaction for the pneumococcus was $P_H$ 7·8 to 8·0, and the broth + 3·0 to + 3·5 (3 to 3·5 per cent. acid) to phenolphthalein. Their experience with meningococcus was similar to that with pneumococcus.

For colour tests they use phenol-red (phenolsulphonephthalein) as indicator. By its aid they have devised a system of testing the reaction of broth, using standard solutions in a graded series—yellow, pink, red ($P_H$ 6·6 to 8·4). Such a series of colour standards are prepared at the American Army Medical School, and issued for use in the service. They give details of their method of bringing a medium to any desired $P_H$ value.

Two tables are appended. The first is one of standard salt solutions. These solutions are made with varying proportions (given in c.c.) of N/5 $KH_2PO_4$, NaOH, KCl and $H_3NO_3$, with a range of $P_H$ 6·6 to 8·4. The second, is a list of the more important organisms, with their acid and alkaline limits of growth, and the optimum range in terms of $P_H$. There are various comments on these values in the text. W. A. M. S.

**Gildemeister, E.** Ueber den Einfluss erhöhter Temperaturen auf die Oberflächenspannung von Bakterienaufschwemmungen. [**On the influence of increased temperatures on the surface tension of bacterial suspensions.**] *Centralbl. f. Bakteriol.* (&c.), I. Abt., 1919, Orig. **83,** 497.

The author made stalagmometric measurements on suspensions of various bacteria heated to different temperatures to estimate the changes in the surface tension induced by the heat. The technique employed was that of Traube. Cultures were grown on agar slopes and were then washed off with distilled water and centrifuged to remove any particles. Equal quantities of the emulsions being then introduced into test tubes, they were heated for an hour, mostly to 60° C., 80° C., 100° C. and 142° C., and, being afterwards cooled, the drop values were determined by the stalagmometer. The microbes investigated were *B. typhosus*, *B. paratyphosus B*, *V. cholerae*, *V. elwers*, *V. metchnikovi*, *B. dysenteriae* Shiga, *B. coli*, *Staphylococcus aureus*, *B. pneumoniae*, Friedländer, *B. pyocyaneus* and *B. proteus*; the results being expressed in a series of curves, which show that the changes in surface tension are not alike among bacteria. Agreement was found in the curves obtained with *B. typhosus*, *B. paratyphosus*, *Vibrio cholerae*, *V. metchnikovi*, *V. elwers* and *B. pyocyaneus* on the one hand, and in the curves of *B. coli*, *B. dysenteriae* and *Staphylococcus* on the other. The surface tension changes in the case of Friedländer's bacillus and *B. proteus* were peculiar to themselves. The typhoid curve was characterized by a considerable increase of the surface tension in emulsions which had been heated to 80° C., whereas the dysentery series showed no alteration even when they had been heated to 100° C. Friedländer's bacillus showed a loss of surface tension at 80° C. and an increase at 100° C., while *B. proteus* showed a diminution of surface tension even at 50° C. and at all temperatures tried above this up to 142° C.

With reference to agglutination it was found in the first group that, corresponding with the increase in surface tension at 80° C. there was an inhibition of the agglutination, which was partially restored at 100° C., after the surface tension had been lowered. Some paratyphoid strains and dysentery bacilli showed an inhibition of the agglutination although there was no corresponding increase of surface tension, whereas *Proteus X 19* strains showed diminution of agglutination along with lowering of the surface tension. The author considers that the alterations in surface tension as a result of increased temperatures constitute only some of the changes which heat induces, and that all these changes must be taken into account in judging the factors which influence agglutination in the case of heated bacteria. W. B.

**Ellermann, V.** Granulafarvning i Snit af de bloddannende Organer hos Mennesket. [**Granule staining in sections of the haemopoietic organs in man.**] *Hosp.-tid.*, 1919, **62**, 897.

The modern panoptic stains for blood cells in films may be looked upon as nearly perfect. The successful staining of the granules of the cells in the haemopoietic organs in sections is a very different matter as witness the number of different methods recommended in the last few years. Ellermann has taken the trouble to compare these methods with extreme care, and has elaborated a technique as follows. It may be added that in order to get good results his procedure should be rigidly followed in every detail.

(1) The tissues, which need not necessarily be obtained immediately after death, are cut not more than 2 millimetres thick, and placed for 24 hours at room temperature in Helly's mixture with 10 per cent. of formalin (neutral). Helly's mixture consists of corrosive sublimate 5 grm.; potassium bichromate 2·5 grm.; sodium sulphate 1 grm.; aq. dist. 100 c.c.; 10 per cent. of formalin is added immediately before use.

(2) After fixation the tissue is washed in running water for 24 hours, then placed in 70 per cent., 96 per cent., and 99 per cent. alcohol; then into xylol and paraffin. The sections should not exceed 5 $\mu$ in thickness.

(3) Sections treated with xylol, 99 per cent. alcohol, then water and dried with blotting-paper.

(4) Stain for 15 minutes with formalin-eosin (neutral formalin 0·25 c.c. added to 5 c.c. of 1 per cent. eosin (bluish), Kahlbaum).

(5) Wash in distilled water at 45° C. for 3 to 5 minutes. Dry with blotting-paper.

(6) Stain for 30 minutes in a 0·5 per cent. sol. of eosinate of methylene blue (Jenner) in methylic alcohol, to which is added an equal quantity of distilled water.

(7) Wash in distilled water for 5 to 10 minutes. Dry with blotting-paper.

(8) Differentiate in 100 per cent. alcohol for 2 to 4 minutes.

(9) Finally clear in xylol and mount in dammar dissolved in xylol.

All nuclei are deeply stained and show their structure well. Connective tissue and the reticulum of the tissues is pale blue. All granules are stained, the neutrophil a dirty red or reddish brown, eosinophil bright red and basophil deep blue. Erythrocytes and erythroblasts are brownish or reddish. Plasma cells are easily recognized by their peculiar nuclei and the homogeneous grey-blue protoplasm which shows a lighter often reddish part at the side of the nucleus. A necessary condition for the microscopy of such preparations is a good light—either daylight or artificial light with a glass globe of copper sulphate.

(The neutralization of the formalin solution above referred to is carried out with calcium carbonate. The neutrality may be maintained by placing some small pieces of marble in the bottle.) W. B.

**FASIANI, G. M.** Preparazione e studio di sieri immuni contro germi anaerobagenti di gangrena gassosa. [**Preparation of immune sera against the anaerobic agents of gas gangrene.**] *Arch. Ital. di chir.*, 1919, **1**, 35.

After having studied 70 strains of anaerobic germs isolated from cases of gas gangrene complicating gun-shot wounds, Fasiani attempted the preparation of immune sera against those species which he concluded were the agents of infection. In deciding the latter point he relied upon (1) the results of bacteriological examination of the invaded tissues, exudates and blood, regarding those species as the more important which appeared to predominate or were related to generalization of the infection; (2) the effects of experimental inoculation of guinea-pigs with the pure culture, the germ which reproduced most exactly the features of the disease, being regarded as probably the true cause. On this basis he concluded that gas gangrene was due to the *B. perfringens* (*B. phlegmonis emphysematosae* of

Fraenkel, *B. aërogenes capsulatus* of Welch-Nuttall), or the *B. oedematis maligni* of Ghon and Sachs (*Vibrion septique* of Pasteur), or the *B. oedematis maligni* of Novy (*B. oedematiens* of Weinberg and Séguin), or to these in association.

*Anti-B. perfringens serum.* The microbe exists in three varieties, *communis, parvus,* and *mucosus*; and in preparing the sera Fasiani treated horses for prolonged periods with intravenous injections of total cultures of each of the three strains separately. In the sera thus obtained Fasiani was able to demonstrate the presence of precipitins, agglutinins, and antitoxins: bacteriolysins and anti-complements were absent. These properties appeared to be specific, inasmuch as positive results were shown in presence of *B. perfringens* or its products, negative results in presence of other anaerobes. Moreover, the antitoxic reaction was positive in the case of each of the three varieties of the germ, and could therefore be used in serum-diagnosis. The agglutinating and precipitating reactions were much more limited; the latter was positive in a certain proportion of cases only, the former succeeded only in the presence of germs from the strain actually used in immunization. The most striking property of the sera obtained was their antitoxic action: 1 mg. of the serum obtained by injection of the culture of the variety *mucosus* neutralized 5 lethal doses of the toxin (guinea-pig); 5 mg. of the serum from the variety *parvus* neutralized 2 lethal doses. The preventive action of the sera was equally evident, conferring an immunity which rendered the animal for a prolonged period insensible to lethal doses of the culture. The curative action was difficult to estimate owing to the rapid course which characterizes experimental infection.

*Anti-B. oedematis maligni (Ghon and Sachs) serum.* The sera obtained contained precipitin, agglutinin, and antitoxin, but no bacteriolysin or anti-complement. The precipitating reaction was specific, but did not occur constantly. On the other hand, the agglutinating reaction was both specific and constant, and therefore available for serum-diagnosis. As in the case of *B. perfringens,* the antitoxic power was the most marked characteristic of the serum: 1 mg. of the serum neutralized 5 lethal doses of the toxin. Injected into the guinea-pig it conferred an immunity lasting for many days.

*Anti-B. oedematis maligni (Novy) serum.* This serum was found to contain precipitin, agglutinin, anti-complement, and antitoxin, but no bacteriolysin. The precipitating power was limited to the strain which was used for immunization, and the agglutinating action was similarly limited. The anti-complement reaction was positive for all strains.

T. W. P. L.

**BIANCHERI, A.** Tetano postsierico locale, ipertardivo, a evoluzione lenta. [**Unusually late, local post-seral tetanus, developing slowly.**] *Arch. Ital. di chir.*, 1919, **1**, 15.

Biancheri describes a case of tetanus in which the disease first became manifest 14 months after wounding, and in which the symptoms were strictly localized to the wounded limb, and persisted for five months. The patient was wounded on August 24, 1917, by a grenade fragment which became lodged in the right thigh, without causing any lesions of the bone or nerves. An injection of antitetanus serum was given on the same day and repeated 24 hours later, and again on the third day. The fragment was not extracted and no special surgical treatment was adopted. The wound healed within two months, after trifling suppuration. In January 1918 the man returned to the front and was able to endure the hardships of trench life without inconvenience on the part of the wounded limb. In October 1918, on the day following a march of 25 miles, the leg felt harder than usual and was slightly tender, and there was some stiffness in the knee-joint. Patient remained at his post for 15 days, during which the symptoms increased in severity; slight spasms also became noticeable, and the stiffness of the limb was painful. On admission to the hospital he was found to have some difficulty in opening the mouth, all the muscles of the right thigh were in a hypertonic condition and passive movements, which were free at the hip and ankle, were impossible at the knee-joint. There was a slight degree of trismus, but the muscles of the neck and trunk were unaffected. Under serum treatment gradual improvement took place, which however was arrested by a severe attack of diarrhoea persisting for several weeks. At this time the right leg was in a position of permanent deformity: the foot was in a position of equinus with the toes flexed; the knee slightly flexed, the hip semi-flexed and rotated outwards. The hamstring tendons stood out prominently in the popliteal space. At intervals the limb was attacked with extremely painful and severe spasms lasting several seconds and associated with tremor. Sensation was unaffected, but the least stimulation of the surface of the lower half of the body immediately produced spasms in the right leg. The tendon reflexes of the two upper and the left lower limbs were exaggerated.

In March 1919 the foreign body, localized by means of the X-rays at the junction of the upper and middle thirds of the thigh, about 2 cm. behind the femur, was removed together with the cicatrix. No evidence of necrosis was present, but the tissues at some distance from the fragment, and especially the subcutaneous tissue, were softened and oedematous. A culture made from these tissues gave negative results: none was made from the fragment, as this was accidentally contaminated. Serum treatment was continued after the operation, a gradual amelioration with final cure resulting.

In view of the possibility of cases of this kind developing into generalized tetanus the importance of early diagnosis is great. When the abdominal muscles are contracted, or trismus and rigidity of the neck, or risus sardonicus are present, the diagnosis is not difficult; but where the symptoms consist merely in localized pains and contractures restricted to the muscles adjacent to the wound or cicatrix, the possibility arises of referring the condition to some lesion of the central or peripheral nervous system, to reflex contractures, to tetany or to hysterical conditions. Biancheri discusses fully the differential diagnosis in these doubtful cases.

Biancheri has been able to find in the literature only seven cases at all comparable with his in regard to the length of incubation. In these cases tetanus developed after 109 days, 133 days, 5 months, 6 months, 6 months, 1 year, and 13 months, respectively, after wounding. In almost all of them, however, the disease appeared after surgical intervention, from which rather than from the original wound the period of incubation should, in all probability, be reckoned. In Biancheri's case the disease developed, 14 months after wounding, apparently spontaneously, unless the march of 25 miles were regarded as the exciting cause. In explanation of this prolonged incubation Biancheri lays stress on the facts that the fragment was not encapsuled, and that the oedematous tissues were at some distance from it, and suggests that the fragment had become displaced into closer proximity to the sciatic nerve, and thus a slow fixation of the toxin by the nervous tissue became possible, with development of symptoms.

T. W. P. L.

**Donati, M.** Tetani latenti e tetani atipici in feriti di guerra. [**Latent and atypical tetanus.**] *Arch. Ital. di chir.*, 1919, **1**, 1.

The preventive injection of antitetanus serum is rarely followed by the development of grave symptoms of tetanus. On the other hand, it is not infrequent to find mild symptoms of the disease appearing after such treatment. and these cases are of two kinds: (1) **Latent tetanus,** in which the microbes are present in the wound or cicatrix, but are unable by their toxins to produce any symptoms on the part of the cerebrospinal centres, owing, probably, to the influence of the preventive injections. (2) **Atypical post-seral tetanus,** in which the disease is in all respects similar to spontaneous tetanus, except that it is attenuated by the action of the serum. This form is probably identical in nature with the partial or abortive spontaneous tetanus which is met with from time to time.

These cases of post-seral tetanus are important, because the symptoms may be so mild as to be overlooked, and because there is a danger of their developing into the grave generalized form, if left untreated. Definite evidence of the disease, such as trismus, and stiffness of the neck may be absent, and an exaggerated reflex excitability the only symptom present. This is illustrated in the following case: The patient received a gun-shot wound of the thigh with fracture of the femur. Sequestra and necrotic tissues were removed and injections of antitetanus serum administered. Within one month the wound was in a good condition of healing and the temperature normal. On the 50th day the discharges again became foetid, and it was discovered that the tendon reflexes of the uninjured lower limb were exaggerated. Serum treatment was again resorted to, with surgical treatment of the wound, and in the course of a month the reflexes became normal and healing occurred. Donati regards this as a case of latent tetanus, in which the toxin generated in the wound was unable to exert its specific action on the nerve centres probably owing to the previous injection, while the reflex excitability was attributable to toxic factors which were eliminated by the surgical and serum treatment adopted.

The following is an example of atypical post-seral tetanus: Eight months previously the patient had received a gun-shot wound of the right leg with fracture of both bones, followed by osteomyelitis, and healing with much shortening of the limb. There was a general exaggeration of the deep reflexes, including those which are more rarely observed and usually elicited with some difficulty. Subcutaneous injections of serum were administered at intervals of six days; after seven injections the reflex excitability diminished and disappeared within three weeks of the final injection. Donati considers that in this case the reflex excitability was a relic of the original infection, which had become attenuated by the first injections; and that the motor cells had from the first been under the toxic influence, which was dispelled by the later injections. On this view it would follow that reflex excitability may be a sign of progressive infection, even in the absence of other symptoms of the disease.

With regard to diagnosis, it has been Donati's custom to examine bacterioscopically the discharges from all gun-shot wounds as a matter of routine. In many cases drumstick bacilli can be demonstrated, and although, exceptionally, these are not the bacilli of tetanus, the latter have morphological characters by which, with a little practice, they can be identified with tolerable certainty. The recognition of the bacillus in this way has enabled Donati to make an early diagnosis, and presumably effect a cure in a certain number of cases. The bacterioscopical examination is rapid, and therefore time is saved and serum treatment can be immediately commenced: cultural and biological examinations should follow in order to confirm the diagnosis. T. W. P. L.

**Kristensen, M.** Undersögelser over Forekomsten of Pfeiffer's Influenzabacil. [**Pfeiffer's bacillus and influenza.**] *Hosp.-Tid.*, 1919, **62**, 777–86, 801–11.

In November 1918 the Serum Institute of Copenhagen issued a report of investigations, conducted by Thomsen, Kristensen, and Thorborg, into the relation of Pfeiffer's bacillus to influenza. The present article by Kristensen marks the conclusion of these investigations, the gist of which was the finding that Pfeiffer's bacillus cannot be regarded as the cause of influenza. Only in 35 per cent. of the cases of influenza could P's bacillus be found in the sputum. In many cases repeated examination of the same patient revealed the consistent presence or absence of P's bacillus. It was demonstrable with equal frequency among complicated and uncomplicated cases of influenza, and was often found late in the disease. It was less frequently found among cases of influenza than among healthy persons or the subjects of tuberculosis and whooping-cough. Its presence in healthy persons bore no relation to their having suffered from influenza or not.

C. L.

**Bing, H. I.** Antallet af röde Blodlegemer i de forskellige Aldre og under forskellige Forhold. [**The number of erythrocytes in relation to age and other factors.**] *Ugesk. f. Læger*, 1919, **81**, 1483–9.

The writer observes that, in spite of recent researches which have not substantiated the common assumption that the normal number of erythrocytes is 5 millions for men and 4·5 for women, these figures are copied from book to book and accepted as unimpeachable standards. He has examined 20 men and 51 women, and has found that among men under 30 the figures range from 4·2 to 6·1 with an average of 5·5 millions. He notes that his countrymen, Bie and Möller, came to the same result in 1914. His average for women was 4·95 millions, as compared with their average of 4·7 millions. The average standard should therefore be put up half a million for each sex, i. e. to 5·5 millions for men and 5 millions for women. He reckons that, in skilled hands, the coefficient of error is 2·3 per cent. which is equivalent to a deviation of about one million in the count. His figures for men under 30 ranged from 4·2 to 6·1 millions—a difference showing within what wide limits the norm is found.

His observations on the blood of 22 men and 21 women over 60 do not confirm Hansen's. The writer's material showed the average for men to be 6·1, and for women to be 5·1 millions. A blood count in the case of a man who had drunk nothing for 12 hours, and who had then been given 1,000 c.cm. of soda water, showed an increase in the number of red cells, not a decrease, as was expected, owing to sudden flushing of the vascular system. A comparison of the figures according as the blood was taken from the ear, abdomen, or tip of the finger, showed invariably higher figures for the abdomen than for the ear, the difference in some cases being as great as 3 millions. No constant differences could be found in the blood taken from an ear previously rubbed or undisturbed. The writer suggests that the high counts associated with old age, alcoholism, &c., may be due merely to changes in the skin and its capillaries. C. L.

## BIOCHEMISTRY

**PALMER, L.** and **KEMPSTER, H. L. Relation of plant carotinoids to growth, fecundity and reproduction of fowls.** *J. Biol. Chem.*, 1919, **39**, 299.

Attention is drawn to the curious association of carotinoids (fat soluble pigments in the leaves of plants) and the fat soluble vitamine. The pigment of butter is derived from the leaves of plants, and passes through the animal to the milk, associated presumably with the fat soluble vitamine. The authors point out that the existence of vegetable oils containing pigment and no vitamine show that the association is probably accidental. They raised white Leghorn chickens to maturity on a diet which they claim to be free from carotinoids, and the only abnormality they obtained was the absence of the natural yellow pigment. R. A. P.

**CHICK, HARRIETTE** and **HUME, E. MARGARET. Note on the importance of accurate and quantitative measurements in experimental work on nutrition and accessory food factors.** *J. Biol. Chem.*, 1919, **39**, 203.

The conflicting results of the many workers in the vitamine field are due in some cases to the lack of quantitative measurements of the amount of a vitamine containing food required for normal growth. In future, work must be quantitative as well as qualitative. R. A. P.

**STILLMAN, E. Studies of acidosis. XVI. Determinations of bicarbonate in the blood plasma of different species by the titration and $CO_2$ capacity methods.** *J. Biol. Chem.*, 1919, **39**, 261.

A further confirmation of the conclusion that the two methods (titration and $CO_2$ capacity) of determining $CO_2$ bicarbonate concentration in the blood can be used interchangeably for clinical work. R. A. P.

**Peters, A. W. Micro-determination of nitrogen by direct Nesslerization and of total solids in drop quantities of human blood.** *J. Biol. Chem.*, 1919, **39**, 285.

The conditions of accuracy of a method described by the author for estimation of the above in 15–30 drops of blood have been found to lie within a few thousandths of a milligram of nitrogen. R. A. P.

**Riggs, L. K. Action of salts upon the metabolism of nerves.** *J. Biol. Chem.*, 1919, **39**, 385.

Using the Shiro Tashiro biometer, the author claims that she has additional evidence that an increased rate of $CO_2$ production is an invariable accompaniment of increased functional activity, and that the increased $CO_2$ production upon nerve stimulation is not due to the heating of the nerve by the electrical current, but is a true metabolic response. R. A. P.

**Sujuira, K.** and **Benedict, S. R. Action of radium emanations on the vitamines of yeast.** *J. Biol. Chem.*, 1919, **39**, 421.

With the view of obtaining light upon the substance attacked by radium in a growing neoplasm, the authors found that the growth promoting properties of yeast were partially inactivated by exposure to radium emanations. R. A. P.

**Okey, Ruth. Studies on the behaviour of inulin in the animal body. II. Inulin in the alimentary canal.** *J. Biol. Chem.*, 1919, **39**, 149.

Inulin, the principal reserve carbohydrate of the Jerusalem artichoke, is a polymer of laevulose, and has been suggested as a substitute for starch in the diabetic diet. In view of the conflicting evidence as to the power of using inulin, the author has investigated (1) whether gastric concentrations of hydrochloric acid will hydrolyze inulin to laevulose—(she concludes that they will, though the inulin would probably not stop in the stomach long enough to allow of much hydrolysis)—and (2) whether any inulin splitting ferment can be found in the faeces. This is found and considered to be due probably to bacteria. R. A. P.

**Osborne, T. B., Wakeman, A. J.,** and **Ferry, E. L. Preparation of protein, free from water soluble vitamine.** *J. Biol. Chem.*, 1919, **39**, 35.

The relative efficiency of different methods of removing the water soluble vitamine from various protein preparations has been tested by comparing the length of life of young rats fed on diets containing the protein for experiment added to a basal ration, supposedly free from water soluble vitamine. Of the proteins tried, crude edestin – a hempseed globulin—even when recrystallized twice was still able to maintain growth, showing that it still retained the water soluble vitamine. On the other hand, even crude casein contained practically no water soluble vitamine. Animals on a diet really free from this vitamine declined in a few days. R. A. P.

**Greene, C. W. Biochemical changes in the muscle tissue of the king salmon during the fast of spawning migration.** *J. Biol. Chem.*, 1919, **39**, 435.

The problem of the fast of the migrating salmon and the building of the sex tissue at the expense of muscle tissue has interested workers since the time of Miescher. The research quoted is an account of analyses of salmon muscle tissue at various distances from the sea. The chief results of importance are the diminution of neutral fats (15 per cent. to 2·24 per cent.) during the migration, which must therefore be supplying the kinetic energy; the consumption of the lecithin from 1·18 per cent. normal to 0·44 per cent. at the spawning ground, and the important result that the protein content diminishes by 30 per cent. from the normal without jeopardizing the protoplasmic integrity of the muscle. This suggests that protein may be stored in the same sense as fat and carbohydrate. R. A. P.

**Greene, C. W. Changes in nitrogenous extractions in the muscle tissue of the king salmon during the fast of spawning migration.** *J. Biol. Chem.*, 1919, **38**, 457.

The total creatine content of the muscles is not essentially changed. Total extractives increase slightly during the greater part of the migration. The percentage of nitrogen in the organic extractives remains approximately constant, but the non-protein amino-nitrogen increases in the fat-free muscle during migration. The concentration of amino-nitrogen relative to the water in the muscles increases from 82–100 mg. per 100 gm. of water coincidently with the augmentation of katabolism. At the beginning of migration also the amount of amino acid is dependent upon the volume of water present, the water therefore helps to control the tissue content. The presence of a mechanism for regulating the concentration of the amino acids in the tissues is discussed. R. A. P.

**Sherwin, C. P.** and **Helfand, M. Comparative metabolism of certain aromatic acids. 3. Fate of p-nitrophenylacetic acid in the organism of fowl, dog, and man.** *J. Biol. Chem.*, 1919, **40**, 17.

Continuing their study of the protective syntheses, the authors have fed by the mouth the nitro body, p-nitrophenylacetic acid. In man 68·7 per cent. was recovered unchanged in the urine, and there was apparently no attempt at a protective synthesis in spite of slight poisonous symptoms. The dog was found to combine 17 per cent. with glycocoll, and the hen conjugated the greater part with the di-amino acid, ornithin. R. A. P.

**Buell, Mary V. Studies of blood regeneration. 1. Effect of haemorrhage on alkaline reserve. 2. Effect of haemorrhage on nitrogen metabolism.** *J. Biol. Chem.*, 1919, **40**, 29 and 63.

The question of the production of acidosis by bleeding has been studied in pigs. The data obtained give no grounds for believing in any severe grade of acidosis for haemorrhages up to 6 c.c. per pound of body weight. The drops in alkaline reserve as measured by the bicarbonates of the blood were slight and did not last long, there was no definite effect upon the reaction of the urine, and no great increase in the ammonia nitrogen excretion after haemorrhage. Struggling upon the part of the animal always caused a decrease in the alkaline reserve. R. A. P.

**Atkinson, H. V.** and **Lusk, Graham. Animal calorimetry. Influence of lactic acid upon metabolism.** *J. Biol. Chem.*, 1919, **40**, 79.

In a search for the real cause of the great increase in heat production after meat ingestion (the specific dynamic action of protein), the authors have been led to believe that the stimulus is provided by the acid products of protein metabolism. Glycocoll and alanin increase the metabolism greatly in the dog, and it has been shown that this is not due to the process of deaminization or of urea formation. This reasoning led to the trial of the effect of the ingestion of lactic acid, which was found to increase the metabolism by practically the same amount as its corresponding amino acid alanin, thereby confirming the authors' views. The experiments further lend support to the belief that the increased production of heat in phosphorus poisoning is due to the large quantity of lactic acid produced, and make it probable that the rise in heat production in severe anaemias is due to the pathological production of lactic acid from carbohydrates (taking place in the absence of an adequate supply of oxygen to the cells). R. A. P.

**Van Slyke, D. D.** and **Salvesen, H. A.** (1). **The determination of carbon monoxide in blood.**

**Salvesen, H. A.** (2). **The determination of blood volume by the carbon monoxide method.** *J. Biol. Chem.*, 1919, **40**, 103, 109.

The Van Slyke $CO_2$ apparatus has been adapted to the estimation of carbon monoxide allowing of very rapid estimations. This has led to an investigation again of the blood volume by the carbon monoxide method in rabbits. The value obtained for rabbits agreed with that of Boycott and Douglas, viz. 1/20·2 of the body weight. Seven determinations in six healthy men showed an average of 1/16·8 of the body weight, more than the value of Plesch, 1/17·9, and less than that of Douglas, 1/13·9 and 1/12·5.
R. A. P.

**Kleiner, I. S. Action of intravenous injections of pancreas emulsions in experimental diabetes.** *J. Biol. Chem.*, 1919, **40**, 153.

The author seems to have found the method by which a beneficial effect may be obtained in the diabetic dog by the restoration of the missing pancreatic element. Dogs made diabetic by the removal of the pancreas were given intravenous injections of unfiltered water extracts of the fresh pancreas, diluted with 0·9 per cent. NaCl solution. The preparation was administered very slowly, the idea being that the pancreatic factor normally is being secreted continuously in small amounts into the blood. There was in most cases a marked diminution in blood sugar, though only of a temporary nature. This did not occur with extracts of other organs. The author thinks that the experiments are suggestive as regards a future therapeutic application, but that the time is not yet ripe for their direct application to diabetes in man. R. A. P.

**Gamble, J. L.** and **Goldschmidt, S. Creatinuria in infants. 1. Relation of creatinuria to acidosis. The elimination of crystal creatine and creatinuria. 2. Relation of protein intake to urinary creatine.** *J. Biol. Chem.*, 1919, **40**, 199, 215.

Infants and children have been shown to differ from the adult by excreting normally creatine in the urine. Creatinuria has been considered by some to be due to acidosis. In the experiments recorded by the authors, no effect was produced upon the creatinuria in the infants experimented upon by variations in the acid-base intake. A further distinction between the infant and the adult appeared in the fact that the infant excreted any ingested creatine more quantitatively than the adult, showing therefore less tolerance. From experiments in their second paper they consider that the preformed creatine in milk (which constitutes such a large amount of the diet of an infant) is responsible in great part for the creatinuria of infants, though they have been unable to obtain more than indirect evidence, owing to the technical difficulty of estimating creatine in milk. R. A. P.

**Harding, V. J. and Young, E. G. Placental feeding and purine metabolism.** *J. Biol. Chem.*, 1919, **40**, 227.

The suggestion had been made by Harding and Fort that any active part played by the placenta in the nutrition of the foetus might be connected with purine metabolism. This was made (1) because they found that placental preparations were much richer in arginine than preparations from other parts of the body, and (2) because Ackroyd and Hopkins had brought evidence to show that arginine and histidine could act as precursors of the synthesis of purine in the growing rat. To obtain further evidence, equivalent amounts of muscle protein and placenta protein were fed to young dogs. The placenta protein was found to increase the excretion of both allantoin and uric acid, indicating some connexion with purine metabolism. It was concluded that the large amount of arginine in the placental diet was associated with the synthesis, though the authors consider that further work is needed as to the relation of this suggestive fact to the normal function of the placenta. R. A. P.

**Abt, J. A. Diabetes in infancy and childhood.** *Endocrinology*, 1919, **3**, 273.

A discussion of the aetiology and clinical features of this infrequent condition. The author has collected the cases described in the literature and supplements these with clinical material of his own. W. C.

**Smith, G. E. Foetal and maternal athyrosis. II.** *Endocrinology*, 1919, **3**, 262.

The author has previously described a thyroid disturbance among new-born domestic animals which he ascribes to a decreased physiological activity of the foetal thyroid. It is a very serious condition, since very few of the new-born animals affected in this way live. The author holds that a diminished function of the thyroid occurs during pregnancy not only in the mother, but also more frequently than is now recognized in the foetus, and that ‘ many of the cases of infantile fatality and of arrested development of children which are now vaguely described as congenital will be found to arise from a lack of function of the foetal thyroid, which may be overcome by a proper diet and conduct of the mother during the gestation period ’.

To insure the normal function of the thyroid the ordinary diet should be supplemented with one-half to one grain of iodine approximately, given (in the form of sodium iodide or ferrous iodide) daily during pregnancy and menstruation and for a period of seven days each month during puberty, especially during the winter months. W. C.

**Hammett, F. S. The functions of the internal secretion of the placenta.** *Endocrinology*, 1919, **3**, 307.

Observations on 177 nursing mothers in the Boston Lying-in Hospital. 10 grains of desiccated placenta were given three times a day for the first two weeks after delivery. The result on the growth of the breast-fed infants was a lessened post-natal decline in weight, a quickened recovery from the preliminary loss, and an increase of 60 per cent. in the rate of growth by the 13th day. The quantity of milk secreted was not affected, but its chemical composition was slightly altered: the amount of protein and lactose was slightly increased, that of fat slightly diminished.

The author denies that the placenta plays any part in the hyperplasia of the mammary gland during pregnancy. W. C.

**Rosenbloom, J. On certain dietary factors to be considered in the treatment of cases of hyperthyroidism.** *Proc. Soc. Exper. Biol. & Med., N.Y.*, 1919, **17**, 28.

The diet should contain the minimum amount of protein, and foods low in iodine content should be selected. C. G. L. W.

**Kahn, M. The protein and lipin content of blood serum of nephritic patients.** *Proc. Soc. Exper. Biol. & Med., N.Y.*, 1919, **17**, 27.

According to Erben, who based his conclusions on the protein and lipin content of the blood, there is a certain type of case of chronic parenchymatous nephritis in which the renal disturbance is secondary to constitutional or 'endocrinic' changes. This view was later confirmed by Epstein. Kann contests this and says that a nephritis of this kind is rarely met with. C. G. L. W.

**Bronfenbrenner, J.** and **Schlesinger, M. J. Serologic method of detecting infection in foods.** *Proc. Soc. Exper. Biol. & Med., N.Y.*, 1919, **17**, 24.

A concentrated extract of the food is made and this liquid tested against a set of immune specific sera. The protein of *B. botulinus* has been detected in so small an amount that 7 grams per os would be necessary to obtain a positive result in a mouse. The presence of a suspected organism can be determined within 24 hours. C. G. L. W.

**Macht, D. I., Greenberg, J. P.,** and **Isaacs, S. Concerning the influence of antipyretics on the acuity of hearing.** *Proc. Soc. Exper. Biol. & Med., N.Y.*, 1919, **17**, 22.

Acetanilide, salol, and aspirin decrease the acuity of hearing, while antipyrin, pyramidone, and quinine increase it.

Acetanilide plus sodium carbonate increase auditory perception. The peculiar synergism of acetanilide with sodium bicarbonate recalls the experiments of Hale who showed that this combination is less toxic to animals than the compound itself. C. G. L. W.

**Scott, R. W. The total carbonate content of the arterial and venous plasma in patients with chronic pulmonary emphysema.** *Proc. Soc. Exper. Biol. & Med., N.Y.*, 1919, **17**, 21.

The experiments were continued with emphysematous patients of the 'large lung' type over a period of six months. They had no cardio-renal disease. The $CO_2$ content is definitely above normal (arterial 74·5 vols. per cent. to 80·2 vols. per cent.). These patients have an unusual tolerance for $CO_2$ in the inspired air. A concentration of $CO_2$ of 11·4 per cent. inhaled for six minutes did not change the respiratory rate of 22 per minute. The respiration volume per minute increased to only 14 litres (normal 10–13 litres). C. G. L. W.

**Scott, R. W. The total carbonate content of the arterial and venous plasma in patients with chronic heart disease.** *Proc. Soc. Exper. Biol. & Med., N.Y.*, 1919, **17**, 19.

Both the arterial and venous plasma in cases of chronic rheumatic myocarditis and valvulitis have a total $CO_2$ content lower than that of normal individuals. The arterial values for arterial plasma show a wider variation (32·0 vols. per cent. to 51·0 vols. per cent.). The more dyspnoeic the patient the lower is the $CO_2$ in the arterial plasma. With improvement in general condition a rise takes place. C. G. L. W.

**Scott, R. W. The total carbonate content of the arterial and venous plasma in normal individuals.** *Proc. Soc. Exper. Biol. & Med., N.Y.*, 1919, **17**, 18.

A method is given for determining the $CO_2$ content of arterial and venous plasma. A modification of the van Slyke method is used. The $CO_2$ content of arterial plasma is fairly constant, averaging 56 volumes per cent. The content of venous plasma is always a little higher than arterial. This is increased after light exercise. During this increase, the content of arterial blood remains about normal. C. G. L. W.

**Foster, M. G., Hooper, C. W.,** and **Whipple, G. H. Metabolism of bile acids. 1. Quantitative method for analysis of bile acids in dog's bile. 2. Normal fluctuations in healthy bile fistula, dog's. 3. Administration by stomach of bile, bile acids, taurine, and cholic acid to show the influence upon bile elimination. 4. Endogenous and exogenous factors. 5. Control of bile ingestion and food factors. 6. Origin of taurocholic acid.** *J. Biol. Chem.*, 1919, **38**, 355.

The authors have made a somewhat comprehensive study of the factors which influence bile acid excretion in the dog. They estimate the taurine, and use the dog for their experiments, because it does not excrete glycocholic acid. The ingestion of fresh dog's bile, of taurocholic acid, or of taurine and cholic acid, is followed by an increased excretion of bile (cholagogue action) with rise in the bile acid output. The ingestion of bile plus sugar caused increased bile acid output with no cholagogue action. Taurine, given by the mouth, or intravenously, did not influence the output of bile acids. Cholic acid, given in the same way, increased the excretion according to the available amount of taurine. This available amount seems to be reduced by fasting. 40–50 per cent. of any taurocholic acid ingested is excreted in the bile during the six hours' collection period.

Both endogenous and exogenous factors contribute to the output of bile acids, the ingestion of protein food, viz. beef heart, caused a very large increase. The taurine probably arises from the cystine of the food or the body. The origin of cholic acid is obscure, and the attempts to increase it by feeding with cholesterol, red blood cells, terpene hydrate, or camphor met with no success. It is further concluded that bile acids are produced by liver cell activity. R. A. P.

**HAGGARD, H. W.** and **HENDERSON, Y. Gas tensions of abdominal cavity.** *J. Biol. Chem.*, 1919, **38**, 71.

The $CO_2$ tension of the abdominal air soon becomes equivalent to that of the pulmonary alveolar air, and is found to fall under conditions of acidosis. Diffusion of oxygen is not so quick as of $CO_2$. The tension of ether in the abdominal air during anaesthesia is 29 mm. of mercury.

R. A. P.

**OSBORNE, T. B.** and **MENDEL, L. B. Nutritive value of yeast protein.** *J. Biol. Chem.*, 1919, **38**, 223.

The use of yeast as a source of water-soluble vitamine has necessitated a revision of the earlier feeding experiments. The authors show that rats can be kept for over a year successfully on a diet in which yeast furnishes the sole source of nitrogen and of water-soluble vitamine. There seems, however, to be incomplete development of the sexual glands.

R. A. P.

**VAN SLYKE, D. D., STILLMAN, E.,** and **CULLEN, E. C. Studies of acidosis. A method of titrating the bicarbonate content of the plasma.** *J. Biol. Chem.*, 1919, **38**, 167.

Van Slyke and his co-workers have improved the titration method of determining the bicarbonate content of serum or oxalate plasma. They add an excess of standard acid, remove the carbon dioxide by rotating the solution for one minute about the wall of a flask, and titrate back with a standard soda to the original hydrogen-ion concentration of the blood ($P_H$ 7·4), using neutral red as indicator. The authors claim good results for the method, so that for clinical purposes an investigator may choose either this titration method, which needs no special apparatus, or the carbon dioxide capacity method with its slightly greater speed of measurement.

R. A. P.

**CESSNA, R.** and **FOWLER, C. C. Studies of the gastric residuum. III. Amino-acid nitrogen.** *J. Biol. Chem.*, 1919, **39**, 25.

The authors have found the average amino-acid nitrogen in 26 normal cases of gastric residuum to be 36·4 mg. per 100 c.c. It bears no relationship to acidity, pepsin, or trypsin content. They think that the high amino nitrogen value obtained by them for the fasting stomach invalidates the special significance of the high values in some cancer cases reported by Zuntz. R. A. P.

**Koessler, K. K.** and **Hanke, M. T.** **Studies on proteinogenous amines. IV. Production of histamine from histidine by Bacillus coli communis.** *J. Biol. Chem.*, 1919, **39**, 539.

This paper is one of a series of five published by the authors upon the subject of the iminazol ring derivatives. In the earlier papers they outline a method for the determination of histamine, histidine, &c., in the presence of one another in small amounts. They then apply the methods in this paper to the question of the circumstances which influence the production of the base histamine from histidine by the colon bacillus—a subject of clear importance in connexion with the production of bases in the large intestine. Their experiments indicate that histamine is not formed in the presence of nitrates or ammonium salts alone, nor in a medium of histidine plus glycerol with no nitrates or ammonium salts. But in a medium containing histidine, glycerol, or glucose, with $KNO_3$ or $NH_4Cl$ as a source of nitrogen, about 50 per cent. of histidine is converted into histamine in the course of two weeks, in the presence of oxygen. Everything is reduced in the absence of oxygen. Histamine always appears when the medium is distinctly acid, and, contrary to the text-book statement, histamine is never formed except in the presence of an easily available source of carbon such as glycerol or glucose. The biological explanation of the action of the bacillus is the production of the amine to neutralize excess of acid formed from the glycerol. R. A. P.

## RADIOLOGY AND ELECTROLOGY

### *Radio-diagnosis*

**Raulot-Lapointe** et **Sorrel, E.** Exploration radiologique au gros intestine. [**Radiological examination of the large intestine.**] *Presse méd.*, 1919, **27**, 289. (*J. de radiol. et d'électrol.*, 1919, **3**, 428.)

The authors try to determine the best method of procedure for each case. They used carbonate of bismuth for the opaque substance, which can be introduced by the mouth (bismuth meal) or by the bowel. The first has the advantage of being the normal method, causing no artificial dilatation, no contractions or spasm, no alteration in the intestinal transit, and at the same time allows one to study the duration and mode of digestion. There are two ways of giving the bismuth meal:

(1) By one meal: the patient takes only one bismuth meal, the course of which in the intestinal tract is observed from time to time. Following Hertz's horary, one is able to note whether there is any modification in the digestive process, and, if so, whether it is due to a general condition or to a localized cause. This method, however, has the disadvantage of requiring numerous examinations, and very rarely gives an image of the whole of the large intestine. The author prefers the following method:

(2) That of several meals. Usually four bismuth meals are given at intervals of about 4 hours, so that the stomach has hardly passed its contents into the large intestine before fresh digestion begins. If the examination be made 22 hours after the first meal was taken, an image of

the whole large intestine is obtained, thus saving work for the radiologist and fatigue for the patient. In most cases, however, not only is digestion not normal, but also the duration of digestion is absolutely unknown. This can only be ascertained by means of giving coloured powders with the food, and, according to the result of this preliminary examination, the times of giving the bismuth meals can be fixed. Administration of several meals enables one to observe the length, form, and relationships of the various segments of the large intestine in its entirety, but if it be a case of defining a structure or of localizing the spot where transit of the food is slower than the normal, one must have recourse to a single meal. Administration of bismuth by injections is of undoubted use in the search for lesions in the sigmoid flexure and rectum, and also has the advantage of being quickly applied, but it frequently gives a distorted image of the colon. The patients should always be examined both in an upright and in a reclining position, so that the mobility and relationships of the different segments of the intestine can be noted. The position of the stomach must always be ascertained at the time of examination by giving a little bismuth milk.

The authors prefer orthodiagraphy to radiography for the making of records. S. U. L-B.

**Hartmann, H.** Le cancer de l'estomac. [**Cancer of the stomach.**] *Presse méd.*, 1919, **27**, 245. (*J. de radiol. et d'électrol.*, 1919, **3**, 428.)

In this article the author describes the method employed by Maingot to determine the existence of residual fluids in the stomach. Six hours before the examination, the patient is given 100 gr. of sulphate of barium in a broth of flour. Normally the stomach, the duodenum, and the jejunum are empty at the time of the examination, but in certain cases of very elongated stomach there may remain a quarter or a fifth of the opaque meal in the absence of stenosis. But when there is stenosis there remains a smaller or larger clot above which there is transparent fluid. Now a fresh opaque meal is given of 100 gr. of sulphate of barium in 300 gr. of a tragacanth mucilage. This mixture, which is not very soluble in water, breaks into large portions which pass slowly through the residual fluid in the stomach, to reach the bottom of that organ. This peculiar method of filling enables one to ascertain the existence of residual fluid even when it cannot be distinguished on the screen unless an air-pocket be present. But this method affords no diagnosis in respect of cancer of the stomach. It is on the existence of shadows with lacunae, and on the fact that the contractions do not pass across the blank spaces, that one bases a radio-diagnosis of cancer. S. U. L-B.

**Tribout, F.** Examen radiologique des biloculations de l'estomac et des résultats opératoires. [**Radiological examination of biloculation of the stomach and the results of operation.**] *Thèse doctorat* (Paris), 1919. (*J. de radiol. et d'électrol.*, 1919, **3**, 375.)

Radiological examination of the bilocular stomach should bear upon two distinct points. (1) Morphology, by examination in the vertical and horizontal positions; (2) physiology of movement, by delayed examination to judge of the evacuation. In the absence of the usual opaque method, the author employed a suspension of carbonate of bismuth, 100 gr. to 250 c.c. water. Examination in the upright position shows the filling of the gastric cavity and the two pockets. Examination in a horizontal position following immediately shows the bilocular image noticeably accentuated. Examination in this position enables the surgeon to make a regional diagnosis in the position in which he will operate. Distension by gas of the gastric cavity should complete the morphological examination. Tonnet's two mixtures are of use for this purpose. This method eliminates the factor of spasm. Study of the physiological movements in true biloculation enables one to verify a condition of more or less marked gastric stasis, the retardation of the evacuation varying from a few hours to several days. The important radiological signs of true medio-gastric stenosis are:—its permanent and irreduceable character and the retarded gastric evacuation. For diagnosis between true and false biloculations, biloculation images given by vertical displacement of the stomach, and especially those caused by compression, must be eliminated. The spasmodic form is not so easy to diagnose. It can sometimes be eliminated by injecting subcutaneously 0·15 mgr. of sulphate of atropin in 24 hours, and by making the radiological examination less than 3 hours after the last injection. This method, however, is not infallible, and distension by gas is preferable, for it always causes spasm to disappear. The rôle of the spasm in medio-gastric stenosis is important. Out of an anatomically large retraction, spasm makes a physiologically compressed one. This partly explains the clinical evolution. The radiologist, in his examination of a full stomach in a non-anaesthetized patient, sees a functional physiological retraction; the surgeon, when operating, finds an anatomical retraction without spasm, the patient being anaesthetized and the stomach empty. The author thinks diagnosis of the cause of a medio-gastric stenosis cannot be made by radiology alone. Congenital biloculation apart, three principal factors are concerned in acquired biloculation—ulcer, cancer, and gastric syphilis—and though X-rays give a morphological diagnosis, they cannot and should not furnish an etiological diagnosis. Radiological examination after operation almost always demonstrates an anomaly of shape, whatever the operation and though the patient may feel perfectly well. S. U. L-B.

**Duval, P.** A propos des aspects biloculaires de l'estomac à l'examen radiologique. [**Bilocular appearance of the stomach in radiological examination.**] *Arch. d. mal. d. l'appar. digest.* (&c.), 1919, **10**, 163. (*J. de radiol. et d'électrol.*, 1919, **3**, 374.)

The bilocular appearance of the stomach under radiological examination corresponds with anatomical biloculations, or is caused by transitory deformities. There are two great classes of biloculations:—

(1) A group without parietal stenosis, which is transitory, and comprises:—

(*a*) Biloculation from atony.
(*b*) Biloculation from compression of the stomach.
(*c*) Spasmodic biloculation.

(2) Radiological biloculations which correspond to mid-gastric stenosis from changes in the wall of the stomach. These are recognizable by the following characteristics:—

Persistence of the image in all positions, in manual compression of the pyloric pouch or in insufflation of the stomach. Appearance, at the moment of ingestion of the contrast meal, of a single upper pocket, then, after some time, of a thread of bismuth which comes to a lower pocket. Several radiological examinations are necessary for the diagnosis. The author thinks the surgeon himself should be present at the examination; a practice he always follows himself before deciding on operation. S. U. L-B.

**Japiot.** Le canal nourricier de l'iléon, son aspect radiographique et son intérêt pour le diagnostic des fractures de l'aile iliaque. [**The nutritive canal of the ilium, its radiographic aspect and its importance in diagnosis of fractures of the iliac wing.**] *Arch. d'électric. méd.*, 1918, **26**, 195. (*J. de radiol. et d'électrol.*, 1918, **3**, 139.)

The nutritive canal is situated at the posterior part of the internal face of the ilium. Its position varies in individuals. It usually is V-shaped with the apex below and has branches of unequal size. It is not very often visible on radiographic prints and must be sought for on the negative by means of the negatoscope. Though fractures of the iliac wing are easily recognized when they are complete, if they are only fissures they can be confused with the shadow of the nutritive canal. In a doubtful case it is best to take a radiograph of both sides, so as to make a comparison.

W. S. L-B.

**Knox, R. The examination of the liver, gall-bladder, and bile-ducts.** *Arch. Radiol. & Electroth.*, 1919, **24**, 37, 79, 119, 156.

A careful and critical examination of the present position of radiology in reference to the diagnosis of gall-stones which embodies much original observation. The anatomical arrangements of the parts under discussion are considered and the chemical composition of gall-stones is correlated with the shadows that they produce on the photographic plate under experimental conditions outside the body. In this part of the work details and illustrations are given to show that demonstration of calculi on the negative varies considerably according to the penetrating power of the rays used and the amount of superposed liver substance. That this should be the case in view of the different degrees to which calcium salts enter into the composition of gall-stones is intelligible, but the experiments cited and the illustrations (including penetrometer scale effects and information as to the use of or absence of an intensifying screen) give a precision to radioscopic work on gall-stones that was much needed. Various details are given as regards preparation of the patient in order to obtain the best results, including questions of position. A section is devoted to differential diagnosis, and in this connexion stress is laid upon the value of lateral radiograms. In fact the author states that 'lateral pictures should be taken in all kidney and gall-bladder examinations'. Short histories of some clinical cases with their radiological findings and copious abstracts from the most important literature upon the subject conclude a practical paper that is based upon a careful experimental basis. W. S. L-B.

**Dausset, H.** Orthodiagrammes montrant l'augmentation anormale de l'aire cardiaque dans la position couchée. [**Orthodiagrams showing abnormal increase of cardiac shadow in the recumbent position.**] *J. de radiol. et d'électrol.*, 1919, **3**, 385–8.

The systematic comparison of the cardiac shadow in the vertical and horizontal positions does not appear to have yet been made. An examination of a large number of men—healthy, sickly, or ill—in a convalescent centre has shown that the appearance in the two positions may coincide almost exactly, or show displacement upwards without increase of cardiac area, or reveal an increase of size in decubitus. The relationship between these findings and the patient's condition is as follows:—

In a normal man of healthy tone the heart shadow hardly varies in size or position on standing or lying down. It is spread out considerably in those who are ill or debilitated. The hypotonicity of muscle in these cases coincides with a decreased arterial tension and also with respiratory insufficiency. Experiments on an athlete, a well-known boxer, showed hardly any change in the two positions, but when viewed immediately after the daily training exercise the heart shadow was considerably smaller when vertical, and a little less markedly so on lying down. N. H. M. B.

**Colanéri, Jh.** Étude critique des signes radiologiques des abcès du foie. [**A critical study of the radiological signs of liver abscess.**] *J. de radiol. et d'électrol.*, 1919, **3**, 395-402.

The literature suggests that it is easy to obtain radiological confirmation of a clinical diagnosis of liver abscess, but in the author's experience it is not always a matter of simplicity, especially when a case has baffled the clinicians and is sent to the radiologist for a definite differential diagnosis. In an exhaustive discussion of his experiences he divides the X-ray evidence of liver abscess into two groups, static or radiographic, and dynamic or radioscopic.

**Static.** The plate should be exposed at the end of expiration and with the diaphragm motionless, and the following conditions may be found and must be measured accurately.

(1) Elevation of the dome of the diaphragm on one side as compared with the other, but with regular and well-rounded curve. This is suggestive, but not a certain evidence of liver abscess, as is proved by cases quoted. Enlargement of the left lobe can be distinguished from enlarged spleen by the intervention of the stomach area between the liver and splenic shadows in the latter case.

(2) Bossing or irregularity of the convexity of the diaphragm. This is only of value if well marked, and distinction between pleuro-diaphragmatic adhesions and liver abscess must be made by screening for the effects of respiratory movements.

(3) Alteration of the costo- or cardio-diaphragmatic sinus, either by lessening of the size or clearness of the area. Neither sign alone is convincing, but the two occurring together are strong evidence of abscess.

(4) The lower border and the left lobe. The lower border may be high, corresponding to the raised upper level, and indicating a small liver, but this does not exclude an abscess. A depressed lower border with raised arch implies enlarged liver and is then suggestive of abscess.

All four signs seldom appear together; when they do there is undoubtedly suppurative hepatitis.

**Dynamic.** (1) Elevation of a side of the diaphragm with normal, impaired, or absent mobility on respiration. This may also be due to pleuritic or perihepatic adhesions, while abscess may occur in a mobile liver and be absent in a fixed one.

(2) Alteration of the curve of the diaphragm on respiration. A boss

may be seen although it was not visible on the plate. If of unvarying appearance during inspiration and expiration, and of the same degree of density as the neighbouring liver, this constitutes the only definite pathognomonic sign of liver abscess.

(3) Clouding of the costo-diaphragmatic sinus may be from pleurisy or a small quantity of pleural fluid. If there be a slight boss protruding into the sinus, and of persistent shape, as well as fluid or clouding, one can say that there is suppuration.

In the series of cases examined for suspicion of liver abscess there were found

(1) A predominating sign of raised right diaphragmatic arch.

(2) A frequent sign of diaphragmatic mobility, and

(3) A less frequent sign of diminished clearness of the sinus on the affected side.

The ideal would be that X-rays rather than the trocar should supply the definite diagnosis, but the author finds this degree of precision impossible except when the second dynamic sign is found. N. H. M. B.

## *Radiotechnique*

**Glocker, R.** Eine neue Messmethode zur Untersuchung der Zusammensetzung von Röntgenstrahlungen. [**A new method of measurement for the investigation of the composition of Röntgen rays.**] *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1919, **26**, 363.

After an introductory survey of the methods hitherto employed for investigating the character of a beam of Röntgen rays, the author describes a photographic method for this purpose. Every procedure which is to serve as a direct experimental solution of the problem of ray analysis must satisfy three conditions, viz. the heterogeneous rays must be divided into several components; the intensity of each of these components must be separately measurable; and their hardness must be simultaneously determined. The X-ray spectrometer provides an accurate means of examining the constitution of a heterogeneous beam, but a less complicated and quicker method is desirable. The chief difficulty lies in separating the heterogeneous rays into components, and the author uses the secondary rays emitted by an irradiated metal for this purpose. If these secondary rays be of wave-length $\lambda_A$, then incident rays of wave-length greater than $\lambda_A$ will not excite them and rays of wave-length appreciably less than this will only do so to a small extent. Hence if, when the metal is radiated by a heterogeneous beam of Röntgen rays, it emits a secondary radiation, there must be a component of wave-length $\lambda_A$ in the original beam. The intensity of the secondary radiation is proportional to that of the exciting radiation, and thus a method of measuring hardness and intensity simultaneously is afforded. In his photographic method, the author radiates five metals at once, and receives the secondary radiation on a photographic plate. The intensity of the blackening on the plate may be compared with a standard. This method is, however, subject to the objections which may be raised against all photographic comparisons of intensities, so a quantitative application of this procedure, in which the secondary rays are received by an electroscope, is described. The author finds that the use of three radiators, the wave-lengths of the characteristic radiations of which are 1·0, 0·5, and 0·3 A.U., is sufficient for ordinary purposes.

The application of the method to the investigation of the influence of the conditions of working a tube on the constitution of the rays produced is explained in numerous examples. It is shown that measurements of mean hardness by the Benoist, Wehnelt, and similar scales yield ambiguous results; the equality of the mean hardness of two beams does not indicate that they are of the same composition. In the case of the Benoist scale it is found that the result depends on the ratio of the intensity of the soft rays to that of the middle group, the intensity of the very hard rays scarcely coming into account. Tubes of different types are not comparable, therefore, by such scales, but when tubes of the same make are examined the results obtained with a Benoist scale agree with those obtained by the author's method. This method affords a simple means of classification of the radiations from Röntgen tubes. It is suggested that the character of the radiation most suitable for any particular diagnostic or therapeutic work should also be standardized. If this were done, the best tube for the examination or treatment of any part of the body could be readily selected from the tubes available. J. R. C.

## *Radio-biology*

**Russ, S., Chambers, H., Scott, G. M., and Mottram, J. C. Experimental studies with small doses of X-rays.** *Lancet*, 1919, i, 692.

The experiments were carried out on rats and deal with certain effects upon the circulating lymphocytes and upon the behaviour of animals irradiated with small doses under various conditions towards inoculation with Jensen's rat sarcoma. The authors started by stabilizing as far as possible the tube conditions. They used for the research a Coolidge tube worked by an induction coil at an alternative spark-gap of 4 cm. between spheres 5 cm. in diameter, and yielding, therefore, a 'medium' or 'medium soft' composite ray. The actual output at any given time was estimated electroscopically by utilizing a minute portion of the beam at a distance of 6 metres from the tube; if necessary, corrections were made by altering the primary current or the duration of exposure. Speaking generally, when the animal is 30 cm. from the anode and the tube is running under the condition indicated an exposure of 12 secs. constitutes a 'small dose'. It corresponds to about $\frac{1}{200}$ of the lethal dose for Jensen's rat sarcoma cells. So far as actual absorption by the animal is concerned this was estimated by comparison with the effects of a standard radium preparation upon a photographic plate. Dealing with the behaviour of the lymphocytes the authors show by curves that irradiation is followed by a 50 per cent. drop in the number of circulating lymphocytes and this, in turn, is followed by a more gradual rise. The amount of fall is fairly constant for all degrees of 'small dose' and is complete in about one hour; the subsequent rise is slower as the dose increases. This rise may overshoot the mark and by suitable selection of repeated 'small doses' a very high degree of lymphocytosis is sometimes attained. On the other hand, heavy doses of X-rays lead to lymphopenia. The behaviour of rats modified in one or other of these two directions by irradiation towards inoculation with Jensen's rat sarcoma was then considered. It was found that treatment with suitable amounts of 'small doses' tends to increase the resistance to inoculation while treatment with large doses will break down an already existing immunity. Nevertheless, the relationship between the lymphocytic count and the susceptibility to inoculation is not simple, for an animal with a very high lymphocytosis may develop a rapidly growing tumour and an animal with lymphopenia may be immune. The authors regard the lymphocytosis round a growth—particularly if inoculated in the rat, or a metastasis in man—as evidence of a local defensive mechanism. They point out that the modern therapeutic method of protective irradiation after operation tacitly implies exposure of distant parts of the body to 'small doses' and urge that the patient may be expected to react in a general sense as well as in a local sense. Their experiments indicate that under certain conditions defence against outlying groups of malignant cells, already in existence, might be improved, in others it might be broken down.

The paper represents much work, but is rather severely compressed. It would seem that routine blood examinations ought to form a part of irradiation treatment, particularly in the case of malignant disease, but it is not easy to form an idea as to the actual part played by the lymphocytes. Their lack of paraplastic substances and their comparative lack of cytoplasm make it difficult to understand how they can act by virtue of some addition to the constituents of the plasma, while there is no reason to believe that they act directly, e.g. by phagocytosis. The facts that they are present in relatively large numbers, and that these numbers fluctuate between very wide limits, indicate that they are cells of great importance to the economy, but in the absence of knowledge as to their natural life history it is impossible to visualize what a lymphocytosis or a lymphopenia ultimately means. It is practically certain that if immunity and susceptibility to malignant disease be bound up with the lymphocytes it will be after a complicated fashion, not a simple one. It is satisfactory to know that the investigation is still proceeding vigorously. W. S. L-B.

## *Electrodiagnosis.*

**Piéron.** Des réflexes labyrinthiques provoqués par excitation unilatérale. [**Some labyrinthine reflexes provoked by unilateral excitation.**] *Compt. rend. Soc. de biol.*, 1918, **81**, 540. (*J. de radiol. et d'électrol.*, 1918, **3**, 143.)

Excitation by warm or cold water (Barany) or by galvanic current (active electrode to the mastoid, the other on the forehead or face) provokes reactions of four kinds.

1. **Sympathetic irritation.** Sensation of dizziness with dazzling, almost approaching unconsciousness, with feeling of instability and sinking—sensation of constrained breathing and worry—nausea and sometimes vomiting—cold sweats in certain cases (mydriasis), but these may be only the result of the disagreeable sensation the current produces. There is likewise reason to put aside the sensations relevant to electrical excitation of the skin, of the chorda tympani, of the auditory and optic nerves, &c. It is a subjective vertigo independent of the direction of the current or of the excited part of the labyrinthine apparatus.

2. **Tonic variations of the skeletal muscles.** Excitation of one labyrinth only produces a hypertonic influence on the extensor muscles on the

same side with probable hypotonia of the flexors on the same side and probable hypertonia of the flexors on the opposite side accompanied by very clear hypotonia of the extensors on the opposite side. The direction of the current does not influence this action. In man, the loss of equilibrium is only clearly visible in the lower limbs.

3. **Ocular positions.** Electric unilateral excitation gives movements to the eyes correlative to the head, in the sagittal and lateral direction and in contrary order to these; an intense and prolonged excitation can provoke nystagmus.

4. **Cephalic positions.** At the closing of the circuit the head inclines to the side of the labyrinth that has been excited when the electrode is positive and the opposite side when it is negative. On the vertico-lateral canal excitation manifests itself in a predominating manner, but the vertico-sagittal canal can also be excited (active electrode retro-mastoid, the other on the zygomatic arch), there are then symptoms of nutation.

To sum up. Unilateral excitation of a vestibular apparatus involves two classes of effects in man of which the thresholds can be very different;—

1. Sympathetic irritation and tonic muscular variation due to general excitation.
2. Head and eye movements in an opposite direction dependent upon excitation of the vertico-lateral or the vertico-sagittal canals.

W. S. L.-B.

**Piéron.** Des réflexes toniques relevant du fonctionnement normal ou de l'excitation bilatérale des labyrinthes. [**Some tonic reflexes resulting from the normal function or bilateral excitation of the labyrinths.**] *Compt. rend. Soc. de biol.*, 1918, **81**, 545–550: (*J. de radiol. et d'électrol.*, 1918, **3**, 143.)

In passing the galvanic current from one ear to the other, an excitation of the **vertico-lateral canals** is caused, the direction of the passage is opposite in the two labyrinths, the effects are similar: inclination of the head towards the positive, repulsion of the head from the negative pole.

The **vertico-sagittal canals** are not excited in this way, on the contrary, two simultaneous unilateral excitations (one electrode in front of the mastoid, the other against the zygomatic arch) enables them to react, for their symmetry is identical (superposable by translation).

When the current passes in the same direction in the two circuits, there is nutation forward if the positive is retro-mastoid and above all backward nutation if it is zygomatic. The eyes have a compensatory balancing movement (looking downward or upward).

The **horizontal canals** have a mirror symmetry. In order to excite them, it is necessary to employ two circuits as mentioned above, but this time in an opposite direction; the effects of the excitation of the sagittals are thus annulled and the addition of the effect of the horizontal canals is obtained. The result is a rotation of the head in the plane of the canals and moving in the same direction, real or apparent, that corresponds to the direction of the excitation (rotation towards the right for a right ampullipetal current) and a displacement of the eyes in the same direction as the rotation of the head, but at a lesser speed. W. S. L.-B.

### *Diathermy.*

**Cumberbatch, E. P. Elevation of the body temperature by the diathermy current. Path of the current in the body.** *Arch. Radiol. & Electroth.*, 1919, **24**, 173-80.

When the diathermy current is passed from hand to hand the greatest rise of temperature is found in the wrists, which are the narrowest part of the conducting medium. There is also a smaller rise of temperature to be noted in distant parts, such as the groin and popliteal space, which can only be accounted for by the heating of the circulating blood as it passes through the arms. The increase is greater on the flexor surface of the arm than on the extensor, the latter being largely composed of bone, which is a poor conductor. The difference is more marked when the current is passed through the flexed elbow, the flexor aspect providing the shorter path. With flexion of the wrist the anterior surface is hotter for the same two reasons, but when extended there is little difference between the temperature at front and back, because the structures at the back are less efficient conductors. Experiments with the legs produced similar results.

When the current is passed across the trunk there is less general heating produced, and it is unlikely that the internal organs are effectively warmed except by a prolonged treatment by this method, though the condenser couch is probably more efficient. Two experiments were made to test whether any rise of temperature could be detected at the abdomen, but none was found greater than that from the original experiments with the current from hand to hand, and due to the body heating. It is hard to say what is the exact course of the current in so complicated a conductor as the human body, but there is a probability that it distributes itself throughout the tissues, less travelling by the more resistant tissues and vice versa.

From the results of these experiments the author deduces rules for the proper application of electrodes, and methods of producing the desired results by diathermy. N. H. M. B.

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